LIGHTNING IN A BOTTLE:

HOW AIR FORCE CULTURE CONTAINED THE RISE AND FALL OF THE AQM-34 LIGHTNING BUG

BY

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APPROVAL

The undersigned certify that this thesis meets master's-level standards of research, argumentation, and expression.

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DISCLAIMER

The conclusions and opinions expressed in this document are those of the author. They do not reflect the official position of the US Government, Department of Defense, the United States Air Force, or Air University.

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ABSTRACT

Unmanned aircraft have been part of the military arsenal for almost a century. Currently unmanned technology have garnered high visibility within the civilian–political realm and become a force multiplier for military combatant commanders. The acceptance and promotion of remotely piloted vehicles (RPVs) has ebbed and flowed depending on the political, fiscal, and military landscapes. The Lightning Bug was one highly useful iteration of unmanned aircraft. These aircraft began as simple reconnaissance platforms designed for the Cold War against the Soviet Union but morphed into a vital tool in the limited nature of Vietnam. However, despite the tactical, operational, and strategic effects the Lightning Bugs had during the Vietnam War, soon after the conflict ended the Air Force turned its back on the technology.

This study analyzes the major influences that led to the rise and fall of the Lightning Bug. The assessment first sets the context by looking at the dominance of Strategic Air Command (SAC) in the 1950s and 1960s, which created a culture of prestige and power. Next, the paper looks at Tactical Air Command (TAC) during the same periods and the struggles the command faced with relevance and identity. Third, the author looks at how the Vietnam War set the stage for TACs assumption of dominance within the Air Force. Finally, this paper tackles how the cultural battle of two commands influenced the rise and demise of the Lightning Bug program. This paper is a testament to the importance of culture as its influence pervades all aspects of an organization—including decision-making.

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Introduction

> *The emergence of drones has opened a Pandora's Box, the contents of which we are only beginning to explore.*
>
> Hugh Gusterson, *The American Way of Bombing*

For well over a hundred years, inventors have sought to leverage the air domain and provide an advantage over the enemy. For example, during the American Civil War, the Confederacy used pilotless balloons, mounted with bombs, for reconnaissance and infrastructure destruction.[1] In World War I an inventor named Charles Franklin Kettering designed the first "flying bomb" with long-range capabilities. The "Kettering Bug" was 300-pounds, flew at 55 miles per hour, and reached a distance of 40 miles. The technology was still elementary and as the war drew down so did substantial funding for the aircraft. However, in the interwar years, the Navy and Army invested what they could in the idea of unmanned aircraft because they saw it as a force multiplier for overcoming the static nature of war.[2]

The lead up to US involvement in World War II saw another spike in the progression of unmanned aircraft. In 1935, the Navy showed a desire to capitalize on the technology for use in aerial target practice for gunners on their ships.[3] By 1938, the Army began showing an interest

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[1] James P. Meger, "The Rise of the Unmanned Aerial Vehicle and Its Effect on Manned Tactical Aviation," (master's thesis, U.S. Army Command and General Staff College, Fort Leavenworth, KS, June 2006), 1.

[2] World's First Guided Missile: Kettering Bug, Speeches dedicating Kettering Bug to Air Force Museum, March 14, 1964, Box K289.9201-1, Air Force Historical Research Agency, Maxwell Air Force Base, AL.

[3] Dave Sloggett describes in his book *Drone Warfare: The Development of Unmanned Aerial Conflict* that in 1935, US Admiral William Standley, chief of naval operations, on a visit to Britain saw the remote-controlled De Havilland (DH-82B) Queen Bee. Impressed by the potential of the system, he had his staff create a similar system. The creator of the US naval version paid homage to the Queen Bee by calling their versions

in the OQ-series of radioplanes created by the inventor and entrepreneur Reginald Denny. These radioplanes, the OQ-2 being the most mass produced, were target drones controlled through radio signals and used as artillery practice and to shoot down incoming V-1 and V-2 rockets threatening London. The OQ-2 program developed organizationally into its own detachment and deployed to the European Theater of Operations.[4] In 1944, the Army and Navy retrofitted B-17 Flying Fortresses and B-24 Liberators, respectively, in Operations Aphrodite and Anvil. A nearby B-17 "mothership" controlled the modified aircraft (then called BQ-7 and BQ-8). These unmanned aircraft were laden with 25,000 pounds of explosives and either dropped bombs on or flew into targets.[5] Ultimately, due to issues with navigation, maintenance, and poor success rates, the two services scrapped the concept after the war.[6]

During the Cold War, interest in unmanned aircraft piqued once again. Nuclear parity with the Soviet Union proved the notion of warfare among superpowers required the utmost delicacy for fear of escalation. A key factor for the US was its devotion to reconnaissance. In 1948, Ryan Aeronautical Company developed the Q-2C Firebee, which was the first drone designed specifically for reconnaissance missions. Development continued, consisting of improving radar signature and flight characteristics, but heavy investment into the concept did not

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"drones." (22)

[4] Capt Wheeler B. Bowen, Letter. Radio Controlled Target Detachment, United States Army, Box 539.902A (Feb-Jun 1945) – 540.01 (16 October 19430-8 January 1944), File 539.9061 (5 November 1943 – 5 October 1945), Air Force Historical Research Agency, Maxwell Air Force Base, AL.

[5] John D. Blom, *Unmanned Aerial Systems: A Historical Perspective* (Fort Leavenworth, KS: Combat Studies Institute Press, 2010, 48.

[6] The aircraft still took off with a pilot and flight engineer. Once the crew got to a pre-determined point, the crew checked all systems, and then the other B-17 took remote control of the aircraft. The crew was responsible for arming the weapons and then had to bail out of the aircraft. This was dangerous because the crew had to jump from the aircraft into a 180-knot slipstream, which can be particularly detrimental at low altitudes.

occur until political leaders made the safety of personnel a priority. In 1954, the Central Intelligence Agency (CIA) U-2 reconnaissance aircraft gave the US an overflight observation capability the Soviets could not match. However, as a countermove, the Soviet Union bolstered its high-altitude missile defense system by developing the SA-2.[7] On 1 May 1960, American U-2 pilot Francis Gary Powers was shot down by an SA-2 over the Soviet Union and was captured, thereby revealing the problematic nature of strategic reconnaissance.

In 1962, CIA U-2 missions focused on Cuba. The battlespace proved even more complex because the Soviets had provided at least 11 sites worth of SAMs to the Cubans for defense. In October, U-2 coverage of Cuba was constant, and by 13 October, Kennedy had learned of the SAM threat. On 27 October, a SAM shot down a U-2 pilot named Rudolph Anderson. Tensions between the two countries increased to an insufferable level. U-2 flights ceased after Anderson's death. The Air Force operationalized the modified Firebee, now called the Fire Fly, and prepared it for action. As the Cuban Missile crisis reached fever pitch, Strategic Air Command's (SAC) Fire Fly, carried by a DC-130, stood on alert at the end of the runway ready to launch. Air Force Chief of Staff General Curtis E. LeMay did not want to tip the United States' technological "hand" to the Soviets, and thus decided not to use the Fire Fly to support the Cuban Missile Crisis. Ultimately, the crisis came to a resolution; however, the potential use of unmanned aircraft was ramped up, beginning with the creation of the Lightning Bug series of remotely piloted vehicles (RPVs).[8]

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[7] Thomas P. Ehrhard, *Air Force UAV's: The Secret History* (Arlington, VA: Mitchell Institute Press, 2010), 6.
[8] Curtis Peebles, *Dark Eagles: A History of Top Secret U.S. Aircraft Programs* (Novato, CA: Presidio, 1995), 83-89.

Figure 1. The Kettering Bug

Source: Ian G. Shaw, "The Rise of the Predator Empire: Tracing the History of U.S. Drones," Understanding Empire, 2014, accessed 10 November 2016, https://understandingempire.wordpress.com/2-0-a-brief-history-of-u-s-drones/.

Figure 2. OQ-2A Radioplane Production Line, 1942.

Source: Richard A. Botzum, 50 Years a Target Drone Aircraft, Northrop Corp., 1985 at "Remotely Piloted Aerial Vehicles: The Radioplane Target Drone," accessed 19 March 2017, http://www.ctie.monash.edu.au/hargrave/rpav_radioplane3.html

Vietnam

America's involvement in Vietnam is perhaps one of the most politically charged events in US history. The Army, Navy, and Air Force all devoted assets and resources in an effort to extinguish the aggressive and deadly actions of North Vietnam against South Vietnam. Based on geography, leadership, and resources, the North Vietnamese muted many US military advantages. Naval surface and submarine assets proved relatively ineffective in terms of their impact, and American Army

forces faced unfamiliar and irregular warfare tactics.[9] The unconventional nature of the war in Vietnam stifled many land-based actions and resulted in high casualties, which led the US to look to the air for another solution.[10]

Unlike the ground or sea wars, the air war over Vietnam had significant effects that reverberated throughout the context of the Cold War. In his book *America in Vietnam*, Guenter Lewy postulates that one main factor in the decision to use airpower was its relatively low cost and the low risk of an air campaign against North Vietnam compared with the commitment of US ground forces.[11] This application of airpower began the era of "modern" air warfare, but also introduced robust defensive measures. In the beginning, Vietnamese defenses were rudimentary but quickly increased, mainly due to Soviet assistance, and included MiG-17 aircraft, more acquisition radars, and fighter radar control for ground-controlled interceptions.[12] By 1965, the Soviets supplied SA-2 SAM systems, which further bolstered North Vietnamese defenses.[13]

Unfortunately, one of the side effects involved in taking the offensive is to expose one's forces. While air campaigns had an effect on the battlefield, they also created the opportunity for North Vietnamese defenses to shoot down aviators, leading to captures and encampment. Between 1964 and 1973, Americans were prisoners of war (POW) in as

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[9] Marshall L. Michel, *Clashes: Air Combat over North Vietnam, 1965-1972* (Annapolis, MD: Naval Institute Press, 2007), 1.

[10] According to the 1962 FM 100-5, which was the Army's operations doctrine, unconventional warfare was war conducted by local personnel and resources to further military, political, or economic objectives. In a Cold War scenario, the doctrine explained that this consisted of fighting a war for the hearts and minds of men but did not explain how to achieve victory in unconventional warfare. Walter E. Kretchik, *U.S. Army Doctrine: from the American Revolution to the War on Terror* (Lawrence: University Press of Kansas, 2011), 183.

[11] Guenter Lewy, *America in Vietnam* (New York: Oxford University Press, 1978), 41.

[12] Michel, *Clashes*, 2-7.

[13] The SA-2 SAM system consisted of an early warning that searched for aircraft, the Fan Song fire control radar that tracked the aircraft, and the Guideline missile that destroyed the aircraft.

many as 13 facilities in North Vietnam. One of the most well-known prisons was Hỏa Lò Prison, also known as the "Hanoi Hilton," originally built as a French colonial complex for political prisoners. The treatment of US prisoners varied depending on the location of the facility and the time of the war. Early on in the American involvement, US prisoners experienced the application of severe torture methodologies. Beginning in October 1969, the torture regime tapered, and prisoners' lives became tolerable; however, for those trapped, there existed a strong desire to leave captivity.

B-52 bombings during Operation Linebacker aimed to end American involvement in the war. B-52 missions never struck prison camps, but gave the prisoners a sense that America was actively fighting to end the conflict. The mixture of aerial bombardment and reconnaissance created a balance of capabilities. The AQM-34 Lightning Bug remotely piloted vehicle (RPV) provided one such reconnaissance capability. Navy Captain James A. Mulligan, a prisoner of the Hanoi Hilton, stated in an interview, "Sometimes we heard the little drone. Sometimes we saw it. After a while, the usual comment was 'there goes the little guy!' On Christmas Day, I was standing out in the open in the middle of the compound when a drone approached overhead. I figured it was taking pictures, so I just stood and smiled up at it. I figured somebody looking at the picture back there might just recognize me."[14]

By the early 1970s, drones easily and impressively maneuvered inside lethal airspace. Unlike manned aircraft, which caused early warning alerts to be set off when they entered within range, the Lightning Bug had the ability to avoid detection measures and operate with relative impunity. The drones' ability to enter the heart of cities such as Hanoi and fly over prisons represented a morale booster for the American

[14] William Wagner, *Lightning Bugs and other Reconnaissance Drones* (Washington: Armed Forces Journal, 1982), 202.

prisoner population. As the war continued, political and military leadership demanded more from the Lightning Bug. In the 30 days between 20 December 1972 and 19 January 1973, the drones flew 100 sorties in support of Operation Linebacker II, executing low-level battle damage assessments of the Hanoi area. On January 20, 1973, one drone flew directly over the Hanoi Hilton at an unusually low altitude. The prisoners waved and shouted in a sign of recognition and positive spirits.[15] What the unarmed drone was doing was just as influential to the captives as a show of force—a show of presence and encouragement.

The North Vietnamese released American prisoners in early 1973. The release was the result of Operation Homecoming, a diplomatic negotiation that concluded US military involvement in Vietnam. On 12 February 1973, the first of 591 US prisoners began repatriation, and return flights continued until late March. When testimony before the House Appropriations Committee was finally released on 26 February 1973, it was the first time that a US official had confirmed the use of unmanned aircraft for reconnaissance in Southeast Asia—a secret that had been held for eight years.[16] Unfortunately, by 1980, despite their usefulness, RPVs were completely absent from the Air Force inventory.

[15] Wagner, *Lightning Bugs*, 206.
[16] Wagner, *Lightning Bugs*, 202.

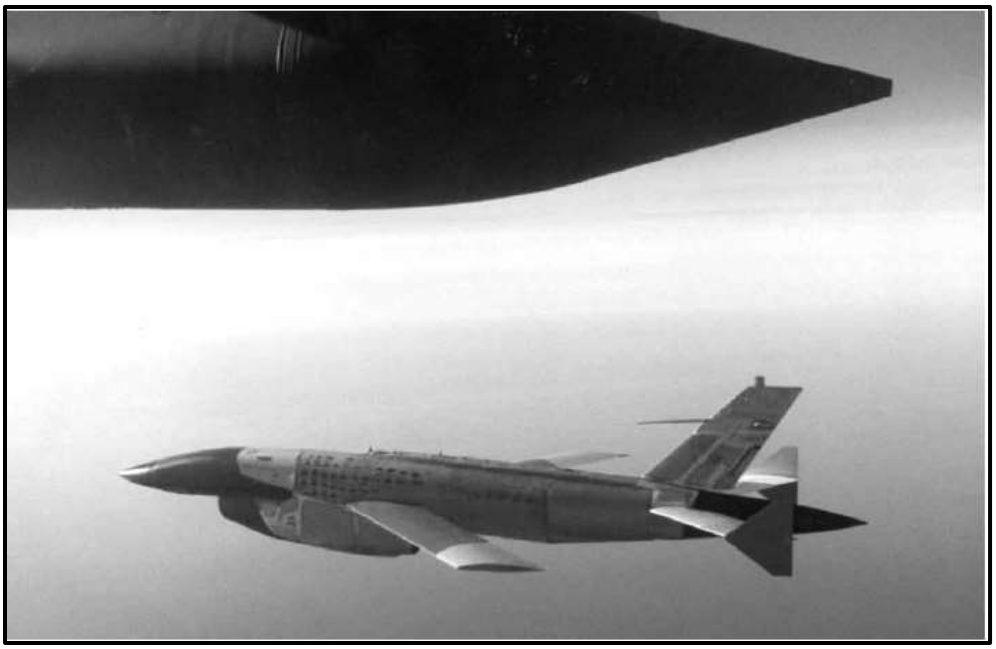

Figure 3. AQM-34 Lightning Bug in Flight

Source: Thomas P. Ehrhard, Air Force UAVs: The Secret History (Arlington, VA: Mitchell Institute Press, 2010), 7.

Reinvigoration

As of 2017, the use of unmanned aircraft is a booming business in both the military and civilian sectors. Nearly all branches of the military are investing in the research and development of unmanned capabilities to bolster their forces. The Air Force, in particular, has reached new heights in technological advancement in the field. No longer referred to as drones in the Air Force, remotely piloted aircraft (RPA) have proven to be capability-gap fillers with their long loiter times, intelligence capabilities, kinetic effects, and communications infrastructure. For example, the MQ-1B Predator and MQ-9 Reaper, built by General Atomics, allow for minimized forward footprints of personnel due to remote split operations (RSO). RSO is enabled by a data network that

sends the pilots inputs from the "cockpit" on the ground, potentially thousands of miles away, to the aircraft, and back in only two seconds.[17]

In the Fiscal Year 2017 budget, the Air Force has requested $1.136 billion in drone procurement spending, $551.9 million in research and development, and $42 million for construction. Incredibly, this request is a 26 percent reduction from the $2.279 billion allocated in Fiscal Year 2016. The MQ-9 Reaper is the Air Force's biggest expenditure regarding unmanned aircraft with $906.1 million in procurement, $151.4 million for research, and $10.5 million for construction. The procurement of AGM-114 Hellfire missiles is second to the MQ-9 Reaper in Air Force RPA spending. Next, the Air Force's priority is the RQ-4 Global Hawk (high-altitude, long-endurance surveillance RPA), which is not slated for new aircraft purchases but has been allocated $49.3 million in spare parts, modifications and upgrades, and other miscellaneous logistics items.[18]

In a 2015 interview with the *Washington Post*, Secretary of the Air Force Deborah Lee James stated, "The field of remotely piloted aircraft or RPA, as we call them, is one of our most important career areas. This capability is something that our combatant commanders all across the globe want more of, and the demand for these services has gone up and up and up."[19] Additionally, the Department of Defense has expanded the

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[17] RPA like the MQ-1B and MQ-9 fly from a Ground Control Station (GCS), which includes the pilot station controlling the aircraft. RPA operators reference the GCS as a cockpit in order to correlate it to manned aircraft for understanding purposes.

[18] Dan Gettinger, *Drone Spending in the Fiscal Year 2017 Defense Budget*, report, Center for the Study of the Drone, Bard College (Annandale-on-Hudson, NY: Bard College, 2016), 3. The Air Force no longer buys MQ-1B aircraft. Additionally, the Air Force is slowing the phasing out of MQ-1B use due to the increased capabilities the MQ-9 provides, such as weapons payload, systems redundancy, and performance characteristics.

[19] Lillian Cunningham, "Air Force Secretary Deborah Lee James on women, drones and budget uncertainty," *Washington Post*, October 1, 2015, accessed November 17, 2016, https://www.washingtonpost.com/news/on-leadership/wp/2015/10/01/air-force-secretary-deborah-lee-james-on-women-drones-and-budget-uncertainty/?utm_term=.df0002a2b897.

number of intelligence, surveillance, and reconnaissance (ISR) combat air patrols (CAPs) from 60 to 90 worldwide.[20] Combatant commanders' demand for unmanned aircraft is voracious with no end in sight. The fledgling innovation used in Vietnam matured into a capability the Air Force is now dependent on for tactical, operational, and even strategic effects.

Interestingly, there is a chasm in this story of progress. After the Vietnam War, the Air Force divested its interest in the Lightning Bug, ultimately selling a small number to Israel and putting the rest into storage. Thus, from the end of the Vietnam War until the early 1990s, the Air Force made no progress developing unmanned platforms. The disconnect between innovation and development is an important puzzle to piece together because it can help the Air Force understand decisions it has made based on a variety of factors. Where might the Air Force be if it had continued investing in the development of the technology? If the Air Force weaponized unmanned aircraft after Vietnam, as they initially attempted, would the attack on 11 September 2001 have occurred? While impossible to know the answer to these questions, it is important to consider the significance of continued development partnered with innovation. In particular, how do promising technologies fail to survive in institutions typically recognized for an innovative spirit? This paper addresses such a question by examining the AQM-34 Lightning Bug during and after the Vietnam War. It also analyzes what factors stifled RPV development.[21] By the end, the paper explains how Air Force culture had the most significant impact on the continuity of unmanned

[20] Simply put, for RPA, a CAP refers to one aircraft above targets or in transit at a given time. In this way, 90 CAPs mean that, at any given time, there are 90 aircraft in the air or in some phase of operations at that moment. The CAP number does not count the excess aircrafts in maintenance or storage.

[21] Other unmanned aircraft existed during Vietnam; however, this paper focuses on the AQM-34 Lightning Bug because it was the most utilized and operationally relevant during the conflict.

aircraft, creating a legacy of lost RPV lessons and depriving the Air Force of intellectual investment in the technology.

Purpose

The tipping point for unmanned aircraft began in Vietnam as the technology provided utility worthy of the cost. This paper focuses on Vietnam because of the colliding factors imposing their influence on the development of unmanned technology. Initial speculation might drive the reader to believe operational effectiveness, fiscal constraints, or outward biases drove disillusionment with RPVs after the war. In fact, the author contends those factors were symptoms and not a root cause. This paper focuses on dissecting why the Air Force terminated the Lightning Bug program.

While the Lightning Bug is central to this paper, culture is foundational to the argument. In an article for *American Psychologist*, Edgar H. Schein wrote the following definition of culture: "Culture can now be defined as a pattern of basic assumptions, invented, discovered, or developed by a given group as it learns to cope with problems of external adaptation and internal integration that has worked well enough to be considered valid and, therefore is to be taught to new members as the correct way to perceive, think, and feel in relation to those problems."[22] Put simply, Schein views culture as a mechanism of socialization that unite people toward common goals. In the Air Force, culture is how various groups associate themselves, which influences preferences, perceptions, and decision-making. This paper examines how culture matters not just in the context of how the Air Force differs from the Army or the Navy, but in how the various communities that

[22] Edgar H. Schein, "Organizational Culture," *American Psychologist* 45, no. 2, February 1990, 111.

compose the Air Force can exert significant control over Air Force direction.

In order to link cultural influence to the Lightning Bug, an unmanned aircraft that showed potential but was eventually discarded, this paper develops the cultural backstories of the communities that dominated the Air Force before, during, and after the inception of the Lightning Bug. By first establishing a solid historical and contextual framework, the reader gains the appropriate cultural optics revealing the complexities of the Air Force environment as the Lightning Bug came into and faded out of existence.

Chapter 2 sets the context by looking at the progression of two different commands. Strategic Air Command (SAC), a product of the Cold War, dominated the Air Force landscape following the Air Force detachment from the Army in 1947. The nuclear mission led to overreliance on this command. Money, talent, and political capital furthered SAC's growth and its domination of the Air Force. The chapter also dissects Tactical Air Command (TAC), which struggled to gain footing during the nuclear age. Tensions between both commands in the 1950s and 1960s grew, and led to TAC grasping for any mission that kept it relevant. SAC dominated Air Force culture and TAC, relegated to a sideshow, fought for survival.

Chapter 3 analyzes the importance of Vietnam in shifting the cultural balance of power. Vietnam presented the Air Force with a conundrum it failed to resolve after its experience in the Korean War. North Vietnam used irregular warfare tactics to counter US conventional superiority. As the conflict in Vietnam progressed, the constrained political objectives and limited military targets created consternation for senior military leaders. Vietnam was a limited war, and SAC was not the instrument of choice. TAC saw an opportunity and exploited the Air Force's need for air interdiction and reconnaissance in North Vietnam,

while SAC kept its forces in the US or striking targets in South Vietnam. The disparity in utility led to TAC vying for power within the Air Force. The shift in cultural dominance was not fast, but was methodical and impacted generations of Air Force personnel.

Chapter 4 reveals the aftermath of SAC and TAC fighting for dominance in the Air Force. This chapter discusses the rise of the Lightning Bug as an asset in the Air Force toolbox. The Lighting Bug's reconnaissance, intelligence gathering, adaptability, and minimization of risk to human life led to commanders demanding more RPVs as the war continued. The chapter then looks at the factors that led to the demise of the Lightning Bug. Multiple smaller factors contributed to the main reason for Lightning Bug divestiture. This section is ultimately a cautionary tale of the dangers of change-resistant culture. The Lightning Bug faced an uphill battle of acceptance and, perhaps, its fate was inevitable.

Based on the scope of the research, this paper has various limitations. First, this thesis remains unclassified. Despite the declassification of many relevant primary resources, many important documents on capabilities and operations are still classified. The classified nature and availability of some literature is stifled due to the black world nature of the project from its inception in the 1960s until its dissolution in the late 1970s. The black world nature of the system is an important component when it comes to understanding the Lightning Bug's funding, acquisition, and fielding practices.

Second, the scope of the paper is focused on the US Air Force and does not discuss the Army, Navy, or international systems or programs. As discussed, the Army and Navy invested heavily in unmanned innovations after World War II, but the strategic environment with the advent of nuclear weapons at the end of World War II led to competition for funds between the branches. Traditionally this theory holds strong,

as shown by Owen Reid Coté who comments in his dissertation, *The Politics of Innovative Military Doctrine: The U.S. Navy and Fleet Ballistic Missiles* that the desire for funds and relevance drive competition between services.[23] This paper does not dismiss the other service's roles in shaping the context of Vietnam. However, for scope, this paper does not examine the Army, Navy, and international systems in depth.

Primary resources proved valuable in linking the apparent value of RPV systems. Research revealed unmanned aircraft were a "hot" item, not unlike how society sees them today. Routinely during the 1970s, *Air Force Magazine* ran advertisements for various unmanned aircraft manufacturers. Moreover, development of new types of unmanned aircraft increased. Developers created new and unique capabilities and attempted to address limitations at that time. During the 1960s and 1970s, the ballet between military scientists and civilian organizations worked well, keeping the systems moving forward. The term RPV replaced drone and served to accentuate human intervention.[24] Despite the current terminology referring to unmanned aerial vehicles (UAV) or RPA, this paper will call them RPVs or unmanned aircraft, as these terms were mainstream in the 1970s. Additionally, this paper uses the terms Lightning Bug, AQM-34, and Model 147.[25]

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[23] Owen Reid Coté Jr., "The Politics of Innovative Military Doctrine: The U.S. Navy and Fleet Ballistic Missiles," (PhD Diss., Massachusetts Institute of Technology, 1996), 334-346.
Cynthia J. Grey, "Beyond the Wild Blue Yonder: Creating an 'Air and Space' Culture in Today's Air Force," (master's thesis, Air Command and Staff College, Maxwell Air Force Base, AL, April 1998), 6.

[24] "Drone" in current terminology refers to an aircraft that flies autonomously with limited flexibility for accomplishing sophisticated missions and is disposable, such as a target drone. This differs from RPAs, which are not intentionally expendable (unless built for target testing), are typically larger, and have a pilot controlling flight operations.

[25] William Wagner and William P. Sloan, *Fireflies and other UAVs (Unmanned Aerial Vehicles)* (Midland, 1992), vi. Of note, the AQM series are air-launched vehicles developed from basic Firebee designs. Most use company Model 147 nomenclature. The "AQM" stands for the following: "A," meaning air-launched; "Q," meaning drone;

The ultimate aim of this thesis is not simply to inform the reader about an institutionally forgotten piece of technology. The purpose is to offer a unique perspective on the character and nature of Air Force culture. This paper uses RPVs as a vehicle of analysis on how culture can lead the Air Force into poor decisions based on tribal desires instead of Air Force-wide effectiveness. The hope is this research can provide clarity or a new perspective for future endeavors regarding innovation and technology.

and "M," meaning missile.

Chapter 2

Foundations of Culture

If you are going to use military force, then you ought to use overwhelming military force. Use too much and deliberately use too much; you'll save lives, not only your own, but the enemy's too.

General Curtis E. LeMay

Strategic Air Command

Spanning from 1946 to 1992, Strategic Air Command (SAC) was the Air Force's flagship organization for strategic influence. SAC was responsible for command and control for two of the three "legs" within the nuclear triad and provided the face of the Air Force.[1] The ethos of SAC began before the institution's creation on 21 March 1946. Early airpower adopters and later leaders, such as generals Henry "Hap" Arnold, Ira C. Eaker, and Carl "Tooey" Spaatz, ascribed to strategic concepts presented by initial theorists such as Italian pilot Giulio Douhet, Royal Air Force aviator Hugh Trenchard, and American pilot and airpower advocate William "Billy" Mitchell.

In 1921, Douhet published his book, *The Command of the Air*, which introduced the idea that quick, decisive victories were possible through early air attacks on an enemy's vital centers.[2] Trenchard believed striking an enemy's centers of gravity resulted in breaking the enemy's will to fight and emphasized the "moral effect" of bombing. The bomber's ability to destroy morale and disturb life made the psychological effects of bombing more impactful than materiel

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[1] The nuclear triad consists of strategic bombers, intercontinental ballistic missiles (ICBMs), and submarine-launched ballistic missiles (SLBMs). SAC maintained control of the strategic bombers and ICBMs.

[2] Giulio Douhet, *The Command of the Air* (Washington, D.C.: Office of Air Force History, 1983), 8-10.

destruction.[3] Mitchell's ideas of airpower permeated throughout the Army Air Corps and later the Air Force. He believed the projection of airpower traded time and space against an enemy attack and an independent Air Force was required for efficient defense of the United States.[4]

Fused together, the ideas of Douhet, Trenchard, and Mitchell formed the foundation for airpower advocates' conceptualization of strategic bombing during the early- to mid-1940s and remained in place for decades. Airpower created the opportunity to seize the initiative and destroy vital centers while avoiding enemy land and naval forces. For Airmen, the strategic nature of airpower also provided an important rationale for autonomy from the Army. After the Japanese bombed the US Pacific Naval Fleet in Pearl Harbor, Hawaii, on 7 December 1941, however, separation from the Army was not feasible or prudent. But once the war ended, it was in the best interest of the Army Air Forces to seek independence. World War II ended on 2 September 1945, and slightly over two years later, on 18 September 1947, the National Security Act of 1947 officially created the US Air Force.

The legacies of early airpower theorists laid the foundation for SAC; however, World War II significantly shaped strategic bombing expectations. First, upon entering the war, America viewed airpower as a method to intimidate and defeat an enemy. During the war, airpower

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[3] Tami Davis Biddle, *Rhetoric and Reality in Air Warfare: The Evolution of British and American Ideas about Strategic Bombing, 1914-1945* (Princeton: Princeton University Press, 2002), 69-71.

[4] William Mitchell, *Winged Defense: The Development and Possibilities of Modern Air Power—Economic and Military* (Tuscaloosa, AL: University of Alabama Press, 2009), 115-126. Douhet, Trenchard, and Mitchell were the biggest and most recognizable names behind what was becoming a global revelation. Mark R. Peattie's book, *Sunburst: The Rise of Japanese Naval Air Power, 1909-1941* discusses how Japanese airpower theorist Nakajima Chikuhei published a short piece titled "War in the Air" in 1918, three years before Douhet. Chikuhei explained how nations able to dominate the air would dominate both land and sea. He also addressed how the construction of a battle cruiser was equivalent to purchasing three thousand aircraft (11-12).

proved the means to inflict sustained destruction on enemy homelands and maximize attrition and annihilation through combined bomber offensives (CBO) in both the European and Pacific Theaters.[5] World War II revealed ineffectiveness in strategic bombing to break the will of the enemy by striking perceived vital centers. The CBO in Europe attacked Luftwaffe targets; V-weapon installations; petroleum, oil, and lubricant plants; railyards; and transportation targets. The CBO set conditions for the execution of the invasion of Normandy during Operation Overlord.[6]

In the Pacific, the US conducted incendiary bombing campaigns against Japan in 1944 and 1945. The Japanese home defenses lacked adequate command and control, radar, and interceptors, leaving the Japanese vulnerable to bombing, especially at night. The first large-scale firebombing raid happened on 9-10 March 1945 against Tokyo. Three hundred twenty-five B-29 bombers dropped napalm against the Japanese capital. Within 16 square miles of the burned down city, casualties numbered 100,000 people. The fire bombings continued and ultimately resulted in nearly 300,000 deaths before the introduction of the atomic bomb in August 1945.[7]

The destructive power of unlimited violence proved effective, but did not end of the war alone. The realized limitations of strategic bombing in Europe and the Pacific led airpower skeptics to question the effectiveness of CBO. In 1941, the American effort to design an atomic bomb was code named the Manhattan Project. On 16 July 1945, the scientists working on the Manhattan Project, led by Robert Oppenheimer, unknowingly shaped the nature of SAC by detonating the first atomic bomb at Trinity Site near Alamogordo, New Mexico, and thrust the world

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[5] Michael S. Sherry, *The Rise of American Air Power: The Creation of Armageddon* (Philadelphia: University of Pennsylvania Pr., 2006), 117.
[6] Max Hastings, *Overlord: D-Day and the Battle for Normandy* (New York: Vintage Books, 2006), 40-42.
[7] John Andreas Olsen, *A History of Air Warfare* (Washington, D.C.: Potomac Books, 2010), 75.

into the nuclear age.

Atomic weapons revalidated strategic bombing theories. The new technology removed a weakness of strategic bombing—duration of time. General George C. Kenney, SAC's first commander, stated, "When we consider that 100 atom bombs will release more foot pounds of energy than all the TNT bombs released by all the belligerents of World War II combined from September 1939 to 14 August 1945 and that effort could be put down in a single attack, it is evident that the long drawn out war is out of date.... No nation, including our own, could survive such a blow."[8] With nuclear weapons, substantially fewer bombing sorties produced equally destructive effects. Evidence of strategic atomic bombing's efficacy showed when the Japanese cities of Hiroshima and Nagasaki fell victim to atomic destruction on 6 August 1945 and 9 August 1945, respectively.[9] The ideas and uses of strategic airpower and atomic weapons during World War II shaped perceptions and doctrine of airpower going forward. How would the Air Force adjust to atomic weapons post-war? The answer was the solidification of an entity to monitor, maintain, and wield those weapons of mass destruction while providing a framework for deterrence—as the SAC motto states, "Peace is our Profession."[10]

Origins of SAC

With the complexities of World War II ending, the introduction of

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[8] Edward Kaplan, *To Kill Nations: American Strategy in the Air-Atomic Age and the Rise of Mutually Assured Destruction* (Ithaca: Cornell University, 2015), 27.

[9] The atomic bomb on Hiroshima proved insufficient to force the Japanese War Council to capitulate and accept the Potsdam Conference's demand for unconditional surrender. The Potsdam Conference was a meeting of Soviet, British, and US leadership in Potsdam, Germany, from 17 July to 2 August 1945 to negotiate the terms for the end of World War II.

[10] C. B. Colby, *SAC: Men and Machines of Our Strategic Air Command* (New York: Coward-McCann, 1961), 3. "Peace is our Profession" is the motto of Strategic Air Command.

atomic weapons into the military arsenal, and the Air Force bidding for independence, military and political leaders latched onto the concept of a strategic force. SAC is less a product of World War II; instead, it established itself within the Cold War. The Cold War was a contest between two incompatible forces: American capitalistic liberalism and Soviet Union communist ideologies.[11]

The Allied Forces and the Soviet Union emerged from World War II as partners who defeated the Axis powers. Soviet security concerns rendered the joint occupation of Europe impossible. To deter Soviet aggression, political and military leaders reformed the structure of airpower within the Army. On 21 March 1946, the Army Air Forces reorganized into three combat branches: Strategic Air Command, Tactical Air Command, and Air Defense Command. The development of SAC provided President Truman, on paper and in rhetoric, a credible strategic force that became a reality as the command grew in size and capability. SAC was the nation's muscle for the conduct of foreign policy and deterrence.

At inception, the SAC mission presented a vision of a force capable of reacting worldwide against any hostile threat as part of a joint contingent or independently if necessary. The concentration of SAC operations fell under five areas. First, *aerial mapping missions* focused on Greenland and surveying from Iceland to Alaska since that was the "top-of-the-world" air route to and from the Soviet Union. Second, training and *goodwill flights* promoted advances in aviation and show support to England, West Germany, Italy, France, Holland, and Belgium. Third, were *maximum effort missions*, which were missions simulating attacks on major US metropolitan areas to develop proficiency against large Soviet cities such as Moscow. Fourth, manufacturers delivered the

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[11] Turner Publishing Company, *America's Shield: The Story of the Strategic Air Command and its People* (Paducah: Turner, 1996), 13.

first fully equipped *F-13As (RB-29s),* which was a B-29 Superfortress modified for photoreconnaissance. Lastly, *aerial mining* added to the SAC maritime mission by developing proficiency at dropping mines from aircraft to disrupt sea lines of communication.[12]

Meanwhile, SAC faced substantial issues as America radically downsized the military in 1946. SAC's decreasing personnel and fiscal allocations threatened to decimate the command. The personnel assigned shrunk from 100,000 in 1945 to 37,092 in 1946. The number of aircraft decreased just as dramatically from 1,300 to 279 and SAC reduced its continental US bases from 18 to 16 in the same year span. SAC's first Commanding General, George C. Kenney, once acknowledged SAC largely was a name on a piece of paper that did not receive the money or resources it needed.[13] By December 1947, SAC experienced a growth, expanding from 279 aircraft to 713 and employing 49,589 military and civilian personnel. In December 1948, the bomber force personnel increased again to 51,965, yet still fell below optimal manning levels based on organizational tables.[14] The personnel issues were detrimental to SAC's effectiveness because of the highly technical and specialized nature of strategic bombing and nuclear weapons.

The external influences of personnel allocation and funding hurt SAC initially; however, two major factors influenced SAC's culture: American fear of the Soviet Union and inadequate training. First, American fear of the Soviet Union defined SAC culture. The preponderance of the Air Force and Department of Defense budgets

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[12] J. C. Hopkins and Sheldon A. Goldberg, The *Development of Strategic Air Command 1946-1986 (The Fortieth Anniversary History)* (Offutt Air Force Base, NE: Headquarters Strategic Air Command, 1986), 9-11. The maximum effort missions flew against cities such as Los Angeles, Chicago, and New York while aircraft simulated dropping all their theoretical bombs.

[13] Norman Polmar and Timothy M. Laur, *Strategic Air Command: People, Aircraft, and Missiles* (Baltimore, MD: Nautical & Aviation Publishing, 1990), 7-15.

[14] Turner Publishing Company, *America's Shield*, 17.

during the 1950s and 1960s went to SAC because it was the sword and shield of the US against Soviet aggression.[15] Political leaders believed the Soviet threat challenged "the free world" and America needed a strong strategic force. The importance bestowed on SAC from civilian leadership afforded the command wide latitude to support their requirements. SAC was the only command capable of deterring Soviet aggression. Soviet development of the hydrogen bomb, coupled with their delivery bombers, created an increasing existential threat to US survival. Liberalism and Communism operated in a zero-sum game and SAC was the only lever with enough power to match Soviet conventional strength in Europe. The criticality of SAC's mission led to a sense of superiority over all other commands and military services. This arrogance permeated from the senior ranks and bred contempt from those fighting for relevance and existence looking up at SAC.

Second, from 1946 to 1948 SAC crews trained in uncomplicated scenarios, lacked any type of bombing standard, and failed at unit readiness. Bombing accuracy suffered with an average miss distance of two miles.[16] Poor solutions for overcoming manpower shortages in critical job functions like navigators, radar observers, electronic officers, and bombardiers hurt unit morale and competency. SAC instituted "cross-training" initiatives, requiring all bombardiers to be thoroughly knowledgeable in radar operations and aircraft commanders to know

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[15] Even the Army felt threatened by SAC's nuclear dominance and sought to find a way to remain relevant in the 1950s. World War II ushered in the mindset in America that land forces were obsolete due to nuclear weapons. In reaction, the Army sought to create smaller, tactical nuclear weapons. The Army also created nuclear-focused units. A "battle group" comprised of a nuclear-age battalion. Five battle groups formed one division, with the division headquarters controlling nuclear-capable artillery. The Army named the unit the "Pentomic" division. Walter E. Kretchik, *U.S. Army Doctrine: From the American Revolution to the War on Terror* (Lawrence: University Press of Kansas, 2011), 172–73.

[16] Col. Philip S. Meilinger, "How LeMay Transformed Strategic Air Command." *Air & Space Power Journal* 28, no. 2 (March-April 2014): 81.

radar observation and bombardment. In essence, cross-training required everyone to know multiple jobs and removed the fundamental strength of specialization. Cross-training lowered skills in primary jobs and decreased overall satisfaction. One squadron leader stated the program "nearly wrecked SAC."[17]

The formation of SAC, and knowing the early challenges it faced, is important to setting the framework of the institutional culture going into late 1948. The SAC community was overworked and inadequately trained. The command also failed to provide personnel with appropriate housing or recreational facilities and mismanaged racial tensions at bases. While facing significant degradation of morale, SAC still enjoyed the fruits of prestige within the military. The SAC culture proved a façade of distinction covering an inept and dismal force. However, despite the disarray, SAC was primed for a radical cultural change. Understanding how juxtaposed the culture and mission were reveals not just why a cultural change took place but also why it lasted so long. Ultimately, the community lacked vision and guidance—what it needed was the right leader and advocate.

Advocacy: General Curtis E. LeMay

The first commander of SAC, General George C. Kenney, held the position from 21 March 1946 to 19 October 1948.[18] His leadership marked a transition as the Air Force began its independence. Kenney proved himself as General Douglas MacArthur's air commander in the Southwest Pacific Theater from July 1942 until the end of World War II. Revered for his service during the war, Kenney' success employing airpower rested in his unique view of airpower supplementing military

[17] Turner Publishing Company, *America's Shield*, 17.
[18] Office of the Historian, *Headquarters Strategic Air Command Key Personnel: 1946-1990* (Offutt Air Force Base, NE: Headquarters Strategic Air Command, 1 April 1990), 3.

operations and the need for air superiority. Kenney had an uncanny ability to relate to others, whether subordinates, peers, or senior ranking officers.[19] Unfortunately, SAC suffered under General Kenney for two reasons that directly influenced the poor culture: experience and schedule demands.

First, Kenney was not a bombardier by trade. He lacked any "real bomber" experience and thus was unable to conceptualize a vector for the fledgling command. Under MacArthur, Kenney led the Fifth Air Force and was primarily a tactical aviation advocate. Second, multiple scheduling demands distracted Kenney from focusing on SAC needs, in particular its culture. Kenney exuded confidence and proved an excellent spokesperson for the Air Force. He enjoyed public speaking and entertained many requests, particularly promoting the value of Air Force independence.[20] Additionally, Kenney also held the position of Senior US Representative on the Military Staff Committee of the United Nations. The demanding schedule prevented Kenney from effectively commanding SAC.

Kenney's lack of bomber mindset and distractions culminated in the summer of 1948, when the Joint Chiefs of Staff asked Kenney to brief them on SAC's readiness. Kenney appeared ill informed and unprepared. The Air Force Chief of Staff, General Hoyt Vandenberg, asked his confidant, famed civilian aviator Charles Lindbergh, to inspect SAC and evaluate its competence and abilities.[21] Lindbergh reported SAC's poor

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[19] Thomas E. Griffith, *MacArthur's Airman: General George C. Kenney and the War in the Southwest Pacific* (Lawrence (Kan.): University Press of Kansas, 1998), xi-xiv.
[20] Melvin G. Deaile, "The SAC Mentality: The Origins of Strategic Air Command's Organizational Culture, 1948-1951." *Air & Space Power Journal* 29 no. 2, March-April 2015, 56.
[21] On 20-21 May 1927, Charles August Lindbergh flew from Roosevelt Field, Long Island, New York to Paris alone. The flight spanned 3,610 miles in 33 hours 29 minutes and 30 seconds. He did it without sleep, on a quart of water and a sandwich. Leverett G. Richards, *T A C: the story of the Tactical Air Command* (New York: John Day, 1961), 46.

training and lack of basic skills. Lindbergh stated, "Personnel are not sufficiently experienced in their primary mission."[22] Vandenberg relieved Kenney and replaced him with Lieutenant General Curtis E. LeMay.

On 19 October 1948, LeMay assumed command of SAC as Kenney went to lead Air University. LeMay maintained command until 30 June 1957, when he became the Vice Chief of Staff for the Air Force and subsequently the Chief of Staff for the Air Force in 1961.[23] Known for his no-nonsense personality, LeMay found success as a squadron commander, then Fourth Bomb Wing commander, and later in 1943 when he commanded the high-visibility Eighth Air Force. In 1944, he became the youngest Lieutenant General in World War II. His accomplishments included mastering mass formation flying, stacking bombers to maximize survivability, training, and designating specially qualified bombardiers and organizing flights to follow their lead. This development gave the US an advantage in precision daylight bombing against German infrastructure.[24] In March 1945, LeMay opted to switch from precision attacks on specific Japanese industries to B-29 low-altitude incendiary bombings and ultimately dropping both atomic bombs.[25]

Despite his operational prowess, LeMay's greatest influence was on the culture of SAC. SAC headquarters moved from Andrews Air Force Base near Washington D.C. to Offutt Air Force Base, Nebraska. This moved allowed SAC headquarters to be out of the reach of Soviet attack. He understood changing the culture of SAC started internally with

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[22] Meilinger, "How LeMay Transformed Strategic Air Command," 77.
[23] Polmar and Laur, *Strategic Air Command*, 4.
[24] Barrett Tillman, *LeMay* (New York: Palgrave Macmillan, 2007), ix.
[25] Gian P. Gentile, *How Effective is Strategic Bombing?: Lessons Learned from World War II to Kosovo* (New York: New York University Press, 2001), 86. Historian Conrad Crane notes LeMay was probably the most innovative air commander of World War II.

deliberate reform efforts to change the mindset of his people.[26] This was not a small task. Walter Boyne, a SAC colonel and later Air Force historian, discussed how early on SAC possessed little sense of purpose.[27] The dysfunction of the command was systemic. LeMay sought to change the culture through his three leadership principles: (1) People need to believe in their work; (2) people need to see visible progress toward the organization's stated goal, no matter how incremental the improvement; and (3) people need recognition and appreciation for their contributions.

First, the blatant errors in preparation of the bomber force left over from Kenney immediately shocked LeMay. Of note, not a single bomber crew was combat ready and the training program proved a disaster. SAC had no target lists, no planned routes against Soviet objectives, and did not control its primary weapon—the atomic bomb. LeMay knew institutional tactical knowledge was fragile and required continual study and improvement. One of LeMay's biggest focus areas was standardization and strict adherence to manuals and checklists.[28] He recognized complacency and a "laissez faire" mentality permeated SAC resulting in substandard identity and purpose. The poor bombing scores and ineffective mission execution resulted in SAC aircrew viewing themselves as substandard rather than elite. LeMay instituted realistic training consisting of complex and demanding tasks crafted to LeMay's high standards on a routine basis. The aircrew rose to the challenge. Simulating "at war" conditions changed the SAC organizational culture. Standardized procedures and methodical execution became the staple of SAC members and set them apart from other military services.[29]

Second, LeMay based his vision of SAC on 24-hour wartime

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[26] Barrett Tillman, *LeMay* (New York: Palgrave Macmillan, 2007), 95.
[27] Warren Kozak, *LeMay* (Washington D.C.: Regnery Press, 2009), 282.
[28] Tillman, *LeMay*, 95, 101-102.
[29] Deaile, "The SAC Mentality," 50.

readiness. For some, readiness meant aircraft production and aircrew proficiency, but to LeMay, it also dealt with off-duty morale. When LeMay assumed command, the living situation in the barracks was barely tenable. Due to the 24-hour nature of strategic operations, few personnel got enough sleep with others coming off-duty at all hours and engaging in normal activities like playing cards or listening to the radio. LeMay established a two-man room standard arrangement with adjoining baths between rooms. This change allowed personnel more sleep in both duration and quality. When time and resources permitted, LeMay began building on-base housing for married personnel.[30]

Third, LeMay did not shy away from recognizing those worthy of praise. One of his most effective personnel motivation tools was the "spot promotion." At the end of 1949, barely a year after assuming command, he learned of numerous vacancies ripe for promoting personnel within the service. Using his influence in Washington and gaining approval from the Air Force personnel director, he had those slots transferred to SAC. The spot promotion gave LeMay the ability to grant immediate promotions to junior officers who excelled at their duties. If a crew managed to stay in the top 15 percent of the rating system he had instituted, then the entire crew received promotions. One of the best ways to earn a spot promotion was to win or place well in the annual SAC bombing competition. LeMay also rewarded those who handled an emergency especially well or devised an innovative procedure. Morale and efficiency immediately improved. The entire organization began to look and act more professional.[31] Under LeMay, trained, prepared, self-assured, and enthusiastic personnel replaced the false

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[30] Tillman, *LeMay*, 96-97.

[31] Kozak, *LeMay*, 300 and Tillman, *LeMay*, 103. Spot promotions proved a double-edged sword. LeMay rewarded people for exceptionalism but those who did something unintelligent or dangerous he demoted or fired immediately. Many careers ended due to LeMay.

bravado once disguising the command. SAC reflected the personality and confidence of its leader.

Culture Leading into Vietnam

US overt involvement in Vietnam began with the signing of a military and economic aid treaty between the US and South Vietnam in 1961. The Gulf of Tonkin incident on 2 August 1964 and subsequent days forced America's hand in further involvement.[32] In 1964, SAC boasted 259,871 personnel, 2,075 aircraft, and intercontinental ballistic missiles (ICBMs). At the urging of President Lyndon B. Johnson and Secretary of Defense Robert S. McNamara, SAC U-2s arrived in Southeast Asia in February 1964 and immediately began photographic reconnaissance of South Vietnam's borders. Early in March, SAC's U-2 contingent settled into permanent quarters at Bien Hoa Air Base in South Vietnam.[33] Additionally, on 20 August 1964, under SAC's control, the first Lighting Bug operations began in Southeast Asia.

During the Vietnam War, SAC remained focused on its nuclear deterrence mission and continued to think of Germany as "ground zero" for the coming World War III with the Soviets. For this reason, SAC made very few changes in its checklists, readiness indicators, or doctrine in preparation for a "brush fire" in Vietnam. SAC sold itself as the only force standing between American freedom and Soviet domination, thus, its preparation for the "real" war was essential. SAC never modified its stance, leading to a massive disconnect between airpower targets and strategic effects. The Vietnam War did not focus on industrial targets

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[32] The Gulf of Tonkin incident involved the destroyer USS *Maddox.* While conducting an electronic intelligence mission in the Gulf of Tonkin, three North Vietnamese P-4 torpedo boats attacked the destroyer. Subsequent attacks on the destroyers USS *Maddox* and *C. Turner Joy* gave President Lyndon B. Johnson rationale to increase offensive military operations against North Vietnam based on the unprovoked attacks.
[33] Hopkins and Goldberg. *The Development of Strategic Air Command 1946-1986.* 124-125.

like Douhet, Trenchard, and Mitchell touted and the Air Force relied on; rather, Vietnam became a nebulous targeting problem. This quandary put politicians and Air Force generals, particularly SAC leadership, at odds because the Air Force did not understand what President Johnson wanted them to execute in Vietnam. Moreover, SAC optimized its operational assets for missions against Moscow rather than North Vietnam. This institutional stubbornness positioned SAC for lumbering and inefficient displays of violence in the Vietnam War—demonstrations civilian leaders were watching.

Tactical Air Command

The Tactical Air Command (TAC) originated the same day as the Strategic Air Command (SAC) and the Air Defense Command (ADC), on 21 March 1946. The three communities came out of World War II with different focuses and specific missions. Establishing the three commands prepared the Army Air Forces for a smooth transition into an independent Air Force in September 1947 and directly transferred into the first foundational commands of the new service. TAC spearheaded the organizing, training, and equipping of assigned and attached fighters, tactical bombers, tactical missiles, troop carrier aircraft, assault reconnaissance, and support unit forces. TAC also enabled tactical force projection around the world. On the battlefield, fighters provided aerial protection of Allied ground troop maneuvers. Tactical units comprised of fighters and bombers isolated the combat zone through air interdiction and cut off enemy supplies and reinforcements by attacking railroads. Reconnaissance aircraft provided visual and photographic information on combat operations. Troop carrier forces airlifted entire divisions to support the invasion of Europe.[34]

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[34] Leverett G. Richards, *TAC: The Story of the Tactical Air Command* (New York: John Day, 1961), 24.

Organizational uncertainty combined with a lack of identity stifled TAC's budget, manpower, and prestige within the Air Force and military early on. TAC remained overwhelmingly in the shadow of SAC. SAC's importance was evident based on its mission, funding, and political backing. TAC, on the other hand, lacked the same visibility, fiscal allocation, and relevance. Thus, it assumed a subordinate role. One key reason military leaders disregarded TAC's mission resulted from the *United States Strategic Bombing Survey* (USSBS). This survey argued that strategic bombing was the most effective, cost-effective, and functional way for the United States to provide security for itself and distant allies.[35]

The perceived capabilities of atomic weapons as well as America's monopoly on nuclear technology created a willingness to reduce military forces and spending after the war. In 1946, every military command suffered from cutbacks and demobilization. President Harry S. Truman reduced defense spending from 40 percent of the gross national product in 1944 to 4 percent in 1948.[36] The reduction in funding dismantled units, sent aircraft to storage or scrapyards, and released personnel back to civilian life. Regardless of force reduction, tensions with the Soviet Union remained, and the Air Force struggled to determine the right amount of force to use.[37]

Lieutenant General Elwood R. Quesada was the first commander of TAC. From its inception, he realized that the Air Force and the military at large did not have consensus regarding tactical air power. Some political and defense leaders felt that tactical air power was potentially an

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[35] R. Michael Worden, *Rise of the Fighter Generals: The Problem of Air Force Leadership, 1945–1982* (Honolulu, HI: University Press of the Pacific, 2002), 28.
[36] Worden, *Rise of the Fighter* Generals, 27.
[37] Mike Hill and John M. Campbell, *Tactical Air Command: An Illustrated History, 1946-1992* (Atglen, PA: Schiffer Military History, 2001), 10.

Army function, particularly in cases where close air support was necessary, whereas others promoted it as an Air Force function. In November 1947, General Dwight D. Eisenhower, Chief of Staff of the Army, supported TAC's role within the Air Force by stating, "Tactical air units belong under the Air Force rather than the Army."[38] Many Air Force generals resented the fact that TAC became a major command. TAC reminded people like Generals Curtis LeMay, Hoyt Vandenberg, and others of the Air Force's previously subservient status to the Army.[39] It took less than two years for TAC to succumb to political confusion. In December 1948, TAC and ADC combined to create the Continental Air Command (CONAC). The structure under CONAC stripped TAC of its units and relegated it to an operational and planning headquarters with no administrative or logistical control.[40] TAC found itself voiceless under CONAC, which focused on concentrating all fighter forces within the United States to strengthen air defense. Additionally, CONAC focused primarily on the administration of the Air National Guard and the Air Force Reserve. The active component of TAC created an anomaly in the system.

In theory, the Air Force-led consolidation attempted to streamline processes, reduce costs, and address the needs of air defense reserves. Quesada recognized those reasons; however, he also felt that the major reason for the consolidation was highly political and served more to shuffle general officer positions than to act in the best interests of the service. Ultimately, Quesada fought for TAC, refused to command the newly formed CONAC, resigned from his assignment, and retired a few

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[38] HQ Tactical Air Command, *TAC Speakers Guide* (Langley, VA: Tactical Air Command, 1961), 1.
[39] Caroline F. Ziemke, "In the Shadow of the Giant: USAF Tactical Air Command in the Era of Strategic Bombing, 1945-1955" (PhD Diss., Ohio State University, 1989), 51.
[40] HQ Tactical Air Command, *TAC Speakers Guide*, 2.

years later. Under CONAC, TAC still felt the weight of SAC. CONAC, which commanded two-thirds of the Air Force mission, garnered only 20 percent of the Air Force budget.[41]

The amalgamation of units into CONAC had two significant effects on TAC and its culture. First, TAC lost its original advocate, Quesada, who was the strong fighter the new command needed. Quesada's resignation did not help TAC's culture develop, and it may have planted seeds of doubt among its personnel. Second, the consolidation reinforced the secondary status of TAC, while allowing SAC to grow and consume more of the Air Force budget, resources, and attention. TAC needed an event to galvanize its forces.

Finding a Niche

The aftermath of World War II left the Korean Peninsula divided at the 38th parallel, with Soviet communist influence in the north and US influence in the south. Korea was important during the Cold War because both the United States and the Soviet Union provided supplies and information to the Korean nations via proxies. Mutual assured destruction loomed over both superpowers; however, and operating via proxy enabled them to have an indirect impact on each other. On 25 June 1950, the communist North Koreans, emboldened by Soviet leader Joseph Stalin, invaded South Korea, initiating the Korean War. The United Nations Security Council condemned the invasion, but the North Korean army did not hesitate to cross the demarcation line.[42]

The Korean War put American nuclear policies to the test. Multiple changes in the security environment had taken place since the United States dropped the atomic bombs on Japan. President Truman

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[41] Worden, *Rise of the Fighter Generals*, 39.
[42] Conrad C. Crane, *American Airpower Strategy in Korea, 1950-1953* (Lawrence, KS: University Press of Kansas, 2000), 85.

relied on nuclear superiority as he reduced the size of the military after World War II. Realizing that the Soviet army was too big for conventional forces to handle, he chose to rely on the current atomic strategy. On 29 August 1949, the American monopoly on nuclear weapons ended with Soviet testing of a nuclear weapon.[43] The basis for the American atomic strategy did not necessitate a monopoly, but it did require either a predominance of nuclear weapons or technical superiority. On 30 September 1949, Truman issued a directive to create a thermonuclear weapon that was vastly more destructive than an atomic bomb. The United States feared falling behind the Soviets. The Cold War became a technological arms race.[44]

Early in the Korean War, it became obvious that the current nuclear strategy was deficient. The lack of concentration of North Korean forces as well as support from allies for atomic weapons made nuclear weapons unrealistic. Like in World War II, conventional weapons became the basis for airpower.[45] With nuclear force untenable, political and military leaders needed to deploy personnel and aircraft to Japan and South Korea. TAC found an opening. On 1 December 1950, the Air Force reestablished TAC as a major command, removing it from under CONAC. Lieutenant General John K. Cannon assumed command of TAC

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[43] The Soviet detonation of an atomic bomb surprised US experts since it occurred three years earlier projected; however, it would be years before the Soviets had an effective nuclear striking capability.

[44] Campbell Craig, *Destroying the Village Eisenhower and Thermonuclear War* (New York: Columbia University Press, 1998), 26. A thermonuclear bomb, also known as a hydrogen bomb (or H-bomb), is a nuclear weapon that uses energy from a primary nuclear fission reaction to compress and ignite a secondary nuclear fusion reaction. The result is greatly increased explosive power compared to single-stage atomic weapons. On 1 November 1952, a thermonuclear bomb detonated with the power of 10 megatons, or 10 million tons of dynamite, over the island of Elugelab in the Eniwetok atoll. In comparison, the atomic bomb that destroyed Hiroshima had an approximately 15-kiloton yield.

[45] William W. Momyer, *Air Power in the Three Wars (WWII, Korea, Vietnam)* (Washington D.C.: U.S. Government Printing Office, 1978), 3.

in January 1951. Additionally, by the end of 1951, the command grew to a peak of 25 tactical wings and 60,000 personnel.[46]

The Korean War provided a unique opportunity for Cannon and for TAC. In the background, the threat of nuclear war between two superpowers loomed. The key purpose of nuclear weapons became ensuring their lack of use. In John Andreas Olsen's edited *The History of Air Warfare*, an author states nuclear weapons did not avert war in Korea, but rather set constraints on the nature and scope of the conflict. The constraints meant avoiding mutually assured destruction (MAD) through deterrence. However, deterrence also reaffirmed the continued relevance of conventional, non-nuclear weapons.[47]

During the war, the North Korean Air Force proved a minimal threat. The air strategy focused on cutting North Korean supply lines to ground forces. TAC maintained control of the air. In October 1950, the Chinese communists sent troops into North Korea in a demonstration of support for North Korea and against perceived Allied aggression. The Allies readjusted their tactical airpower use. The US countered the numerical superiority of the Chinese ground troops by employing airpower more broadly. The air strategy shifted from an initial focus on close air support to a focus on air interdiction against the forward staging bases and main supply lines of the advancing Chinese Army. Due to tactical airpower's constant pressure on the enemy's rear, lines of communication, and engaged troops, the North Koreans negotiated an end to the conflict on 27 July 1953.[48]

The Air Force recognized that tactical airpower could join strategic airpower in the first blows against the source of the enemy's military

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[46] HQ Tactical Air Command, *TAC Speakers Guide*, 3.
[47] Olsen, *A History of Air Warfare*, 86–87. MAD was the theory that nuclear war between two superpowers was escalatory and led to an apocalyptic event, destroying both countries.
[48] William W. Momyer, *Air Power in the Three Wars (WWII, Korea, Vietnam)* (Washington D.C.: U.S. Government Printing Office, 1978), 5–6.

strength; however, the Air Force still did not hold tactical and strategic airpower in the same regard. After the Korean War, TAC came to two realizations. First, for relevance, it needed a tactical nuclear capability. In response, TAC developed the Composite Air Strike Force (CASF) concept for mobile rapid-deployment, which included tactical nuclear attack missions. The idea behind the CASF was to reduce the artificial distinction between "fighter wings" and "bomber wings" and instead delineate force structure based on nuclear and conventional missions.[49] Secondly, the Korean conflict showed the Soviet Union had an alternative to global or general war—limited war. The United States' ability to counter limited war directly related to the success of TAC.[50] The high-visibility arm of American strength, SAC, proved relatively useless in the face of this unique form of warfare. TAC realized that it must be agile and adaptable. TAC also predicted future limited conflicts arising in areas with military vacuums such as Korea, Central and South America, the Middle East, Africa, Taiwan, and Southeast Asia. The countries in these areas were militarily weak and susceptible to various forms of Communist manipulation or aggression.[51] TAC needed to capitalize on the successes of the conflict, and it needed a leader to advocate for the organization as it challenged SAC supremacy. Ultimately, the Korean War provided TAC a potential method to challenge SAC and gain admiration, more command opportunities, funding, and resources.

Advocacy: General Otto P. "Opie" Weyland

Unlike SAC, whose most prominent leader emerged two years into the command's establishment, TAC did not get its first strong advocate

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[49] John Andreas Olsen, *John Warden and the Renaissance of American Air Power* (Washington, D.C.: Potomac Books, 2007), 124.
[50] HQ Tactical Air Command, *TAC Speakers Guide* (Langley, VA: Tactical Air Command, 1961), 6.
[51] HQ Tactical Air Command, *TAC Speakers Guide*, 14.

until six years after becoming a command. General Otto P. Weyland initially assumed command of TAC in July 1950, but General Hoyt Vandenberg, Air Force Chief of Staff, quickly redirected him. On 16 July 1950, Weyland became the vice commander of operations for the Far East Air Forces (FEAF), capitalizing on his abilities as one of the world's best air tacticians.[52] In June 1951, Weyland became a four-star general and assumed command of both FEAF and the United Nations Air Forces. When Weyland resumed command of TAC on 1 May 1954, he found his tactical forces scattered between the Pacific, Europe, and America. Weyland realized the tactical community still struggled to establish an identity and culture that personnel could embrace. Weyland tried to support the culture by developing a sense of relevance and purpose.

At the conclusion of the Korean War, Weyland faced the challenge of refocusing the community. Despite the successes of TAC in Korea, most political and defense leaders revered SAC as the shield of freedom. TAC could handle nothing more than low-level skirmishes. Additionally, most considered the limited war of Korea to be an anomaly. Eisenhower realized that a massive retaliation strategy was inadequate for limited conflicts. However, he also understood that he could not prepare the country for every type of potential conflict, especially with the long-term economic strategies he was pursuing. Publicly, Eisenhower approached limited war with ambiguity, not offering definite situations requiring the use of nuclear weapons.[53]

Lacking clear guidance, military leaders found limited warfare a contentious matter. After taking command of TAC, Weyland was a staunch advocate for TAC's utility against limited warfare. Using his

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[52] Richards, *TAC*, 19.
[53] Charles B. McFarland, "A Sword for All Seasons: General O. P. 'Opie' Weyland and the Emergence of Tactical Air Command" (Master's Thesis, School of Advanced Air and Space Studies, Maxwell Air Force Base, AL, June 2006), 90.

experience during World War II and the Korean War as a basis, he argued that tactical airpower was not only necessary but also probably the best air asset for future conflicts. The premise of his argument was MAD, which created an eventual atomic stalemate.[54] To Weyland, TAC provided a deterrent to limited warfare, just as SAC did for nuclear warfare. Limited warfare provided enemies with an avenue for contention. Weyland traveled and spoke to senior leaders and people within his command, and he expressed TAC's viability as the principle agent for limited warfare. Due to nuclear bi-polarity, which prevented either the United States or the Soviet Union from achieving an atomic advantage, conventional resources must apply that pressure for limited wars.

Weyland ultimately fought for TAC's existence. He attempted not to challenge the status quo regarding the importance of SAC. He routinely emphasized that nuclear weapons should be the basis for American defense strategies, but limited conflicts were likely and required conventional weapons.[55] Weyland lobbied his case against skeptics who saw TAC as expendable. To some within the Air Force, the budget limitations started conversations about reassigning TAC to the Army or dismantling it completely to free up more money for SAC. Weyland commented, "SAC wasn't satisfied with most of the chips . . . they wanted them all."[56] Despite SAC's importance, to Weyland, it seemed like LeMay was trying to undermine TAC's growth.

Weyland was probably correct. Under Weyland, TAC had grown in exposure and relevance. His efforts led to two major increases in TAC's visibility on the world stage. First, in September 1954, TAC took over America's obligations under the North Atlantic Treaty Organization

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[54] McFarland, "A Sword for All Seasons," 89.
[55] Momyer, *Air Power in the Three Wars*, 6.
[56] Worden, *Rise of the Fighter Generals*, 39.

(NATO) to supply tactical airpower to bolster the defenses of Europe against general war.[57] The United States and Italy maintained mutual defense treaties that pledged the United States to defend Italy if attacked. The Italians appreciated the sentiments of support from the United States, but America was a great distance away, and the Soviets were at the Italians' backdoor. America demonstrated its commitment by supplying TAC squadrons to NATO commanders stationed primarily in Italy.[58] Second, TAC developed a tactical nuclear arsenal. TAC did not want the capability; it acquired it out of necessity. TAC therefore became a miniature version of SAC.[59]

Culture Leading into Vietnam

On the eve of escalating hostilities in Vietnam, TAC found itself on unsure footing. Weyland's work proved influential in helping the TAC community develop an identity. In 1964, SAC still had a budget of $6.527 billion, while general-purpose organizations, including TAC, shared $3.030 billion.[60] Although it is obvious that TAC did not compete with SAC, TAC hoped the next conflict played to its strengths.

Four factors stand out about TAC's culture leading into Vietnam. First, experience is a highly valued commodity, especially for promotion. The Korean War created a disparity between SAC's and TAC's combat experience. This wartime experience helped some fighter pilots promote at higher rates than years past. This involvement also gave TAC an

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[57] Richards, *TAC*, 35. The 389th Fighter-Bomber Squadron was the first rotational duty (ROT) squadron to go overseas for six months under the command of USAFE. Initially stationed in France, it moved to Aviano, Italy in 1958, when French General Charles De Gaulle demanded control of US atomic weapons.
[58] Richards, *TAC*, 97–98.
[59] Craig C. Hannah, "Counterflow: The Demise and Rebirth of the USAF Tactical Air Command in the Vietnam Era" (Master's Thesis, Texas Tech University, May 1995), 1.
[60] Air Force Magazine, "An Air Force Almanac: The United States Air Force in Facts and Figures" *Air Force Magazine* 56, no. 5 (May 1973): 150.

advantage going into another limited warfare environment. Second, although the TAC community struggled for years, the cultural mindset of fighter pilots remained strong. The mythos of the fighter pilot took root early in their Air Force careers through social norming and assimilation. Challenging training, selective standards, and high expectations created a breeding ground of excellence. In doing so, TAC differentiated itself from the other commands based on the quality of their pilots.[61] The complexities of the aircraft, coupled with limitations of a single-pilot environment, highlighted the fighter pilots' unique skillsets. Unlike in SAC bombers, which had a crew to handle multiple functions on the aircraft, fighter pilots were the navigators, observers, and bombardiers.[62] Fighter pilots were required to stay physically fit at all times. They needed to be in top physical condition to withstand the strain of high-G pullouts and high-speed aerobatics. TAC focused on "crew conditioning" to help maintain both man and machine in this state of readiness.

Third, due to the crisis of identity and the threat of dissolution in the 1950s, TAC concentrated on nuclear interdiction bombing. This move enhanced the command's relevance but required crews to prepare and train for complex nuclear missions. Pilots spent hours perfecting the delivery of simulated nuclear or thermonuclear bombs by Low-Altitude Bombing System (LABS) maneuvers. Squadron pilots now had to spend a week at a time on alert. The acquisition of nuclear weapons changed the nature of the community. One commander stated, "TAC can't afford cowboys in the cockpit anymore. This is serious business. And believe me, they take it serious."[63] The search for relevance hurt the core of TAC's culture.

Fourth, in 1962, the Air Force introduced beyond-visual-range air-

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[61] Richards, *TAC*, 189.
[62] HQ Tactical Air Command, *TAC Speakers Guide*, 20.
[63] Richards, *TAC*, 98-99.

to-air missiles, which affected the air superiority mission. Many politicians, civilians, and military professionals believed that the new missile variants made aerial dogfights archaic. The radar-guided missiles could destroy enemy targets before the pilot could visually acquire them, which kept pilots from the danger of close-in aerial combat.

All these cultural factors created a cauldron that was ready to boil over. On the one hand, fighter pilots trained to be the best, yet they earned less institutional prestige compared to their SAC counterparts. Additionally, the Korean War provided a glimpse of possible avenues to dominate senior Air Force ranks like Chief of Staff of the Air Force, earn a larger portion of the budget, and garner favor from civilian leadership. At the outset of the Vietnam War, TAC was not tactically ready. Taking on the nuclear mission and beyond-visual-range weapons rendered TAC unprepared for a conventional air war over Southeast Asia. TAC's fighters possessed the wrong equipment for the situation and lacked adequate training for the upcoming limited conflict.[64] However, TAC's cultural strength and adaptability provided the command with the fortitude to overcome such pitfalls.

Conclusion

SAC was a product of the Cold War and rose to prominence based on the capabilities it provided and the threat of the Soviet Union. SAC assumed the mantle with relative ease from Tactical Air Command and Air Defense Command, which were limited in need and criticality based on the nature of the perceived future fight.

SAC's most influential leader, General Curtis LeMay, radically changed the organization. During his tenure, SAC went from a dismal

[64] Hannah, "Counterflow," 2.

accident rate of 65 major accidents per 100,000 hours to nine per 100,000 hours—an 85 percent drop.[65] SAC's emphasis on standardization and processes significantly lowered bomb scores. At the beginning of 1949, crews averaged a miss distance of 3,679 feet; by the end of the year that figure dropped to 2,928 feet for medium bombers (B-29s/-50s) and 2,268 feet for heavy bombers (B-36s).[66]

In addition to operational excellence, LeMay's leadership created a new SAC culture. He realized the internal struggles of his organization and attacked them systematically. LeMay knew life issues for personnel were as critical as military objectives. He enhanced training and improved living conditions and recreational opportunities. LeMay focused on the morale of his people and turned SAC around with innovative processes and ideas.[67] In the end, LeMay sharpened SAC into a definable culture of professionalism and purpose.[68] However, the command struggled with institutional inertia and fixated on the potential fight with the Soviets instead of preparing and embracing for the actual fight in Vietnam. SAC's error was something TAC was more than willing to capitalize on.

The culture of TAC matured very differently from SAC in the 1940s and 1950s. TAC struggled to find an advocate and faced institutional aversion to its mission due to the Air Force focus on strategic nuclear bombing. TAC rose to quasi-prominence due to the Korean War, which breathed life into the ailing organization, but did not provide enough momentum for significant changes in the distribution of power within the service. Eisenhower, and the Air Force at large, seemed to derive different lessons than TAC did in the aftermath of the conflict. Weyland

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[65] Curtis E. LeMay, *Mission with LeMay* (Garden City, NY: Doubleday & Company, 1965), 439.
[66] Deaile, "The SAC Mentality," 64.
[67] Kozak, *LeMay*, 300.
[68] Meilinger, "How LeMay Transformed Strategic Air Command," 85.

saw Korea as the birth of a new type of peripheral conflict that focused on proxy assistance, military constraints, and limited objectives. The Air Force derived two long-term implications from the Korean War. R. Michael Wardon's book *Rise of the Fighter Generals: The Problem of Air Force Leadership, 1945-1982* discussed these implications. First, Korea introduced combat to a new generation of leaders. These leaders never experienced total war, only limited war. Second, the Korean War highlighted a growing split between the bomber and fighter communities. Both communities disagreed on the Korean War's meaning. While, SAC continued to receive more funding and institutional preference, it continued to assert the Korean War was an anomaly. In contrast, TAC saw the Korean War as a glimpse into future conflicts.[69] This division created animosity between the two commands.

Weyland advocated for TAC to assume a prominent role in limited warfare. He also felt that TAC was on the brink of collapse continually under the weight of SAC's dominance. This forced Weyland and his organization into survival mode. He realized that if TAC gained the ability to wage tactical nuclear war, it would also gain a larger piece of the budget. This tactic benefitted TAC fiscally; however, it also restricted the amount of resources, time, and training available for a conventional fight. TAC had to abandon certain specialties like close air support and pure air superiority missions. This decision haunted tactical air forces in Vietnam. Ultimately, TAC's survival meant challenging SAC and convincing decision-makers that nuclear deterrence also meant that conventional airpower was relevant. Unlike SAC, an established and powerful entity with a culture of precision and bravado that developed from its mission, TAC was an upstart unit with something to prove—a cadre of highly skilled, determined, and competitive fighter pilots not

[69] Worden, *Rise of the Fighter Generals*, 42.

only looking to showcase their talents but also, perhaps, to usurp SAC's dominance within the Air Force.

Chapter 3

Taking the Hill

Victory smiles upon those who anticipate the changes in the character of war, not on those who wait to adapt themselves after the changes occur.

Giulio Douhet

US interest in Vietnam dates back to the beginning of World War II. Initially, the outbreak of war had little effect on French Indochina, the territory that includes today's Vietnam. However, the German blitzkrieg campaign that began in May 1940 crushed the armies of the Low Countries, and France, as well as the British Expeditionary Force in six weeks. On 22 June, the French accepted Germany's armistice terms. The Japanese quickly took advantage of French vulnerability in Indochina by closing railways, using French airfields, installing Japanese garrisons, and providing freedom of movement for Japanese soldiers in French territory. In Vietnam, revolutionary leader Ho Chi Minh recognized that France's weakness, the civil war in China, and the destabilized international front presented a unique opportunity. Along with Vo Nguyen Giap, his trusted military leader, Ho Chi Minh established a guerilla intelligence network in 1941.[1]

Japanese control of Vietnam ceased after World War II, and it openly handed control of the nation's administration to the Vietnamese. With no Japanese security enforcement, advocates for Vietnamese independence from France expanded their guerrilla activities. The French, embarrassed at the hands of the Germans and Japanese, sought to reclaim prestige by maintaining control of colonial Indochina. The United States did not approve of French colonial ideals; however, it

[1] Martin Windrow, *The Last Valley: Dien Bien Phu and the French Defeat in Vietnam* (Cambridge, MA: Da Capo Press, 2006), 78-79.

valued France's key regional position in the struggle against the Soviet Union. France's troubles in Vietnam climaxed in 1954 with the Battle of Dien Bien Phu, which resulted in another embarrassing French defeat and a significant success for Communist leader Ho Chi Minh. After signing the 1954 Geneva Conventions, the French agreed to withdraw their troops from North Vietnam, giving Ho Chi Minh control north of the 17th parallel. The Geneva Convention complicated the US position in Indochina because it banned military personnel and equipment in both North and South Vietnam. The international community assumed that, after elections were held, a new president would unite the country. Ho Chi Minh expected to win the election and unify the country; however, when he realized that South Vietnam did not support him, he began gathering his forces in the north to unify the country by force.

The US obsession with Communist containment created a disconnect between its political objectives and military strategy during the Vietnam War. The resulting grand strategy focused more on the costs of war—lives, money, and resources—than on the attainment of objectives. Political leadership was not the only reason for overall failure in the conflict, however. In the post-World War II era, US Air Force leaders relied too much on nuclear deterrence and strategic advantage, and it struggled with any strategy that did not involve total war.

The Vietnam War proved influential for policy makers, military leaders, and especially Air Force personnel. SAC was still the dominant community in the Air Force; it had a culture of status and power. TAC entered the Vietnam War with a second-rate status; it had something to prove. Tensions around power, prestige, and budget bubbled between the two communities, but SAC ultimately wielded the most influence. The impact of the Vietnam War changed everything for both communities, and the effects resonate in the Air Force today.

Figure 4. Vietnam War Map

Source: Vietnam War map. Addison-Wesley Educational Publishers, Inc., 2000.

Vietnam – Brief Overview

Disgruntled after the Geneva Conventions, Ho Chi Minh sought to unite North, Central, and South Vietnam. The Southeast Asian countries were building conventional military forces to counter assumed external threats, such as colonial European powers. The strongest tool of North Vietnam was the network of domestic guerilla organizations based in the South called the Viet Cong. Ho Chi Minh's ability to take advantage of the beginning of the Sino-Soviet split in 1958 proved effective. Ho Chi Minh leveraged his position between the two powers to extort both entities for support. In 1959, the North Vietnamese army (NVA) troops began development of a supply network throughout the jungles of Laos, later known as the Ho Chi Minh Trail. On 6 January 1961, Soviet leader Nikita Khrushchev announced support for the North Vietnamese guerilla and insurgency wars into South Vietnam to speed the spread of Communism in the area.[2] Despite this information, President John F. Kennedy felt the Vietnamese must win the war without US military might. The route Kennedy took sent American military advisors into South Vietnam to show support and to use Vietnam as a testing ground for counterinsurgency techniques. As the insurgency grew in size and audacity, the government of South Vietnam began to receive increased aid from the US in the form of equipment and military advisors as part of the West's global strategy to contain communism.[3]

Some Air Force leaders perceived Vietnam more of a conventional conflict because, in so doing, it increased the need for strategic bombing and jet aircraft. As early as 1961, Major General William W. Momyer, TAC director of plans, presumed that Vietnam would grow into a robust conventional fight more suited to the Air Force's capabilities. He stated,

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[2] Robert F. Futrell, *The United States Air Force in Southeast Asia: The Advisory Years to 1965* (Washington D.C.: Office of Air Force History, 1981), 68-69.
[3] Turner Publishing Company, *America's Shield: The Story of the Strategic Air Command and its People* (Paducah: Turner, 1996), 40.

"In fact, while we considered the merits of various approaches to counterinsurgency warfare, the fighting in Southeast Asia had already passed through that stage of conflict. Soon we would confront an enemy who was trained and ready to employ sophisticated weapons to fight in large, highly organized units."[4]

Active Air Force participation in the war in Southeast Asia began in 1961 when TAC fighter crews recorded the very beginnings of communist aggression in Southeast Asia, particularly in Laos.[5] On 21 October 1961, the fighters intercepted and photographed a Soviet cargo aircraft dropping supplies to the communist troops, highlighting North Vietnam's external support.[6] In 1962 Secretary of Defense Robert McNamara felt the Army was best suited for counterinsurgency operations. McNamara explained, "While naval and air support are desirable, they won't win the war."[7] In contrast, many senior Air Force officers maintained that air strikes against North Vietnam were necessary to end the conflict in South Vietnam. General LeMay, now Chief of Staff of the Air Force, insisted on three points: (1) a small footprint of troops to secure main airfields and strategic areas of interest, (2) concentrated bombing against targets in the heart of North Vietnam, and (3) indirect attacks were not decisive against jungle lines of communication and infiltration.[8] LeMay also insisted that strategic air forces were adequate for successful campaigns in limited warfare.

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[4] William W. Momyer, *Air Power in the Three Wars (WWII, Korea, Vietnam)* (Washington D.C.: U.S. Government Printing Office, 1978), 10.
[5] Craig C. Hannah, *Striving for Air Superiority: The Tactical Air Command in Vietnam* (Texas: Texas A & M University Press, 2002), 8.
[6] Carl Berger and Jack S. Ballard, *The United States Air Force in Southeast Asia: An Illustrated Account* (Washington: Office of Air History, 1984), 211.
[7] Working Paper for CORONA HARVEST Report, "Command and Control of Southeast Asia Air Operations, 1 January 1965, 31 March 1968, vol. I, book I, I-I-22.
[8] General (ret.) Curtis E. LeMay, interview held at the Pentagon, Washington D.C., February 1976. Referenced in Robert F. Futrell, *Ideas, Concepts, Doctrine, Vol. 1: Basic Thinking in the United States Air Force, 1907-1960* (Maxwell Air Force Base: Air University Press, 2004), 259.

The Air Force faced challenges balancing a budget that had to accommodate both a nuclear arm and a competent conventional force. TAC proved organizationally, technologically, and doctrinally ill prepared for a conflict in Vietnam.[9] For example, TAC entered the war in Vietnam with two principal types of tactical aircraft in its inventory: interdiction bombers and interceptors. Neither of these were specialized for air-to-air combat. The McDonnell F-4 Phantom II served primarily in the air-to-air fighter role, and the Republic F-105 Thunderchief performed air-to-ground missions.[10] The other TAC aircraft used in Southeast Asia included the North American F-100D/F Super Sabre, the Lockheed F-104 Starfighter, the McDonnell F-101 Voodoo, and the Convair F-102 Delta Dagger. Most of these aircraft served as interceptors.[11]

The Joint Chiefs of Staff (JCS) recommended to President Lyndon B. Johnson that the United States assume military action in South Vietnam.[12] However, it was not until the Gulf of Tonkin incidents on 2-4 August 1964 that America increased military intervention in Vietnam significantly. The initial wave of substantial US airpower did not start with dropping bombs; it began with strategic reconnaissance. AQM-34 Lightning Bugs supplemented U-2 reconnaissance to observe borders and lines of communication.

As war plans developed, so did the missions. In March 1965, the US began executing plans for a continuing, systematic air campaign

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[9] History, *Tactical Air Command, January-June 1961*, vol. 1, 66–68.
[10] According to Hannah, *Striving for Air Superiority*, 47–48, between 5 August 1964, and 6 October 1970, the Thunderchief flew 157,895 combat and combat support sorties over Southeast Asia with 53.8 percent over the most heavily defended targets in North Vietnam. According to John B. Nichols and Barrett Tillman, *On Yankee Station: The Naval Air War in Vietnam* (Annapolis, MD: Naval Institute Press, 1987), appendix C, 168–169, Air Force Phantoms achieved a 3.07:1 MiG kill ratio for the entire Vietnam War.
[11] Hannah, *Striving for Air Superiority*, 46. An interceptor is designed to become airborne as quickly as possible, fly at altitudes between 40,000 and 60,000 feet at supersonic speeds, then locate and destroy incoming enemy bombers
[12] Momyer, *Air Power in the Three Wars*, 14.

focused on a gradual and sustained aerial bombardment campaign to bring the North Vietnamese to the bargaining table - Operation Rolling Thunder. Political and diplomatic considerations restricted the air raids from using overwhelming force. The plan deemed certain lines of communication below the 19th parallel as important to the North Vietnamese logistical network. The campaign targeted North Vietnamese ports, railroads, marshalling yards, bridges, and supply centers. As supplies funneled southward, they became more difficult to destroy in large quantities because of the absence of open terrain. The air raids of Rolling Thunder continued for three years.

By the fall of 1965, the danger of the SA-2 surface-to-air missile (SAM) necessitated a special collection effort be mounted to search for the missile control, beacon, and fusing signals. Specially equipped Lightning Bugs flew missions over North Vietnamese SAM sites. The drones served two functions, as decoys and information gatherers. First, the Lightning Bug drew the attention of SA-2 sites and forced them to fire Guideline missiles against it. Secondly, the Lightning Bug intercepted vital missile control signals and relayed them to standoff aircraft for recording and analysis before missile impact. The data collected from the Lightning Bug hastened the development of US electronic countermeasures.[13]

By spring 1967, Secretary McNamara and other politicians feared the United States had entrenched itself in the conflict with no way out. Air Force leaders wanted an all-out air offensive while civilian leadership desired negotiations. Additionally, McNamara recognized the folly of depending on airpower to break the will of the Vietnamese. Bombing hurt North Vietnamese war-making capability; however, the

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[13] Turner Publishing Company, *America's Shield: The Story of the Strategic Air Command and its People* (Paducah: Turner, 1996), 42.

predominantly agricultural character of the country showed few signs of weakening due to aerial bombardment.[14] Behind the scenes, SAC struggled with the splitting of their forces. The war in Southeast Asia demanded more B-52 and KC-135 support, while the primary mission of SAC remained the deterrence of nuclear attacks against the US. Toward this objective, SAC continued to maintain approximately 40 percent of the bomber force and nearly 100 percent of the ICBM force on nuclear alert.[15]

Despite discussions of negotiations, on 30 January 1968, the North Vietnamese began the Tet Offensive intended to paralyze the American war effort and deliver a decisive blow to collapse the South Vietnamese Army (ARVN). The offensive also showed the failure of US bombing to disrupt or stop logistical flows from the North to South.[16] The North Vietnamese saw psychological success of the offensive by splitting American public opinion regarding the conflict. President Johnson's lack of public support at home affected his negotiating position with the North Vietnamese and emboldened them to launch a new offensive. In the wake of the Tet Offensive, General William C. Westmoreland (Commander, US Military Assistance Command, Vietnam, or COMUSMACV) requested and received 200,000 additional military personnel to combat Communist aggression.

On 31 March 1968, President Johnson stated in a speech to the nation, "I am taking the first step to de-escalate the conflict.... Tonight I have ordered our aircraft and naval vessels to make no attacks on North Vietnam except in the area north of the demilitarized zone.... Our purpose in this action is to bring about a reduction in the level of

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[14] Guenter Lewy, *America in Vietnam* (New York: Oxford University Press, 1978), 384.
[15] Norman Polmar and Timothy M. Laur, *Strategic Air Command: People, Aircraft, and Missiles* (Baltimore, MD: Nautical & Aviation Publishing, 1990), 107.
[16] Lewy, *America in Vietnam*, 385.

violence that exists."[17] By the 1 April cease-fire, reconnaissance flights over North Vietnam ended but continued over Laos and South Vietnam. On 31 October 1968, President Johnson announced his decision to stop all bombing of North Vietnam but continued reconnaissance flights and interdiction of supplies moving through Laos. The SR-71s and Lightning Bugs provided reconnaissance of northern regions of North Vietnam.[18] At the completion of the Tet Offensive, the government of North Vietnam agreed to begin peace negotiations. Reconnaissance flights showed increased and heavy military flow toward the DMZ along coastal routes. Because of the complexities of the war and falling public opinion, President Johnson did not run for re-election in 1968 and Richard M. Nixon became president on 20 January 1969.

As President Nixon took office, he faced hard strategic decisions. Given the national commitment for gradual withdrawal of American ground troops, airpower was the only tool that could protect departing soldiers and provide time for the South Vietnamese to improve their warfighting capabilities.[19] On 30 March 1972, the North Vietnamese came across the demilitarized zone (DMZ) with 400 armored vehicles, anti-tank missiles, artillery, and 40,000 troops in an effort dubbed the Easter Offensive. Despite knowing of the impending invasion, US civil and military leadership underestimated its strength. The prospect for US negotiations with North Vietnam seemed slim. The Easter Offensive strengthened President Nixon's resolve to support the South Vietnamese with airpower to survive the assault and maintain their independence. The goal of airpower was to stabilize the battlefield for the ARVN.[20]

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[17] Lyndon B. Johnson, *The Vantage Point* (New York: Popular Library, 1971), 435.
[18] Hannah, *Striving for Air Superiority*, 10.
[19] Polmar and Laur, *Strategic Air Command*, 113.
[20] Mark Clodfelter, *The Limits of Air Power: The American Bombing of North Vietnam* (New York: Free Press, 1989), 152–153.; Momyer, *Air Power in the Three Wars*, 31-32. Momyer, *Air Power in the Three Wars*, 31–32.

In May, in response to North Vietnamese intransigence at the negotiating table and weary of inconclusive results, President Nixon resumed nearly continuous, intense bombing actions.[21] Beginning on 10 May, the bombing campaign Operation Linebacker began and differed from Rolling Thunder by attacking above the 20th parallel exposing the Hanoi area to aerial bombardment. The goal was to force North Vietnam to realize the futility of trying to conquer South Vietnam by force.[22] Linebacker's objectives were to restrict the resupply of North Vietnamese external forces, destroy internal stockpiles of military supplies and equipment, restrict flow of forces and supplies to the battlefield, and target areas that minimized the risk of civilian casualties.[23] A new and important weapon entered the US arsenal in 1972. Laser- and electro-optically guided "smart" bombs increased the lethality and efficiency of bomb runs. Linebacker's directive stated, "It is essential that strike forces exercise care in weapons selection to minimize civilian casualties and avoid third country shipping, known or suspected PW [Prisoner of War] camps, hospitals, and religious shrines."[24] Smart bombs allowed the Air Force and TAC to abide by the directive while increasing the number of actionable targets per sortie.

In August 1972, in response to inadequate progress in negotiations, Nixon ordered an increase in bombings of the North. Interdiction was the principal goal of Linebacker during its final two months. The North Vietnamese Easter Offensive in the South began to sputter and fail as supplies waned.[25] Pleased with the results of Linebacker, President Nixon ceased bombing on 23 October above the 20th parallel in expectation of negotiations. An agreement in Paris

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[21] The only restrictions remained Hanoi and Haiphong.
[22] Momyer, *Air Power in the Three Wars*, 32–33.
[23] Working Paper for CORONA HARVEST Report, "Command and Control" vol. 1, book I, 1-1-9, 1-1-24.
[24] Clodfelter, *The Limits of Air Power*, 164.
[25] Turner Publishing Company, *America's Shield*, 44.

seemed close but in December, the North Vietnamese negotiators suddenly began protracting talks and introducing unreasonable new demands, despite concessions on the part of the United States. To conclude a peace agreement, Nixon determined increased military pressure on Hanoi was necessary. The North Vietnamese interpreted suspension of bombing as weakness on the part of the United States and so, on December 18, bombing resumed under an 11-day air campaign called Operation Linebacker II. The goal of Linebacker II was to force a settlement of the war by conducting all-out strikes against North Vietnam's heartland. Large numbers of B-52 bombers and airpower struck vital power centers, causing maximum disruption in the economic, political, and military life of the country. Linebacker II included strikes against point targets by tactical fighter aircraft using laser weapons; neutralization of area targets by B-52s using radar bombing; and suppression of enemy SAMs, anti-aircraft artillery (AAA), and MiGs.[26] The "Christmas Bombings" harmed North Vietnam's industry and economic potential. By the end of the 11–day campaign, 155,548 tons of bombs eliminated all major military targets left in the North. The bombings caused mass evacuations from Hanoi and were essential in forcing Hanoi to resume talks and sign a peace accord.[27]

The signing of the Paris Peace Accords on 23 January 1973 intended to establish peace in Vietnam and end the war. The Paris Peace Accords ended direct US military involvement in Vietnam and temporarily ended the fighting between North and South Vietnam. By the spring of 1973, the North Vietnamese released 591 POWs. Among the prisoners were 33 SAC B-52 crewmembers shot down in Linebacker II. According to Air Force history of the Air War in Southeast Asia, between fighters and bombers, the US dropped a total of 6.162 megatons

[26] Momyer, *Air Power in the Three Wars*, 33.
[27] Clodfelter, *The Limits of Air Power*, 166.

of munitions during the war, or nearly three times the total tonnage it dropped in World War II and over 13 times the tonnage it dropped during the Korean War.[28] Casualty estimates vary, but potentially the cost of the war totaled 3 million Vietnamese and 58,000 American combatants.[29]

The Aftermath

Exiting Vietnam, the SAC and TAC communities experienced different pressures. SAC's dominance over the purse strings had dwindled. Vietnam exposed the limits to strategic airpower, in particular, that overwhelming bombing did not result in victory, and that political leadership could exercise its own prerogatives in war. TAC went into the war unprepared but gained valuable lessons and experience with air interdiction and air-to-air combat over North Vietnam. How the two communities handled the aftermath of the war resulted in diverging operational and cultural paths.

SAC

The Air Force and SAC appeared determined not to adapt to the complexities of war in Southeast Asia. Initially caught off guard, SAC leadership contended that the conflict was an aberration and continued to focus on the threat of nuclear war with the Soviet Union. The United States, politically and militarily, failed to realize two critical factors: the potential for protracted war in Vietnam and cultural differences between those involved. The United States focused on a quick, decisive victory; however, with the conflict fueled by external support and asymmetric wills, the fight lasted nearly a decade. The United States fell victim to

[28] Turner Publishing Company, *America's Shield*, 45.
[29] John Andreas Olsen, *A History of Air Warfare* (Washington, D.C.: Potomac Books, 2010), 126.

cultural hubris, confident that no small country with relatively minimal advanced weaponry could sustain a conflict against it. President Johnson stated there was no way "this raggedy-ass little fourth-rate country" could withstand the might of the United States.[30] The cultural misunderstanding was rooted in values and political will. The North Vietnamese engaged in absolute war with clear goals via blended military means while the US participated in a limited war with unclear objectives.

In 1965, General John P. McConnell, Chief of Staff of the Air Force and another SAC alumnus, realized that the institutional oppression of the fighter generals into subordinated roles did not work in a limited conflict. One example of SAC's subjugation of TAC was the placing of General Walter C. Sweeney as the commander of TAC from 1961-1965. Sweeney arrived from the SAC community and LeMay placed him in command of TAC as a method of controlling the upstart command. McConnell realized the status quo did not reflect favorably on the Air Force and, upon Sweeney's retirement, he assigned fighter pilot General Gabriel P. Disosway to command TAC in July 1965.[31] As the Vietnam War continued, the roles and demands for fighter general officers increased the weight of TAC's credibility, relevance, and political influence.

TAC

TAC entered the war plagued by an organizational identity crisis based on SAC's dominance within the Air Force. In order to compensate, TAC had adopted a tactical nuclear role. However, assuming a nuclear role meant TAC had too few resources to devote to an essential part of

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[30] George C. Herring, "'Cold Blood': LBJ's Conduct of Limited War in Vietnam," The Harmon Memorial Lectures in Military History (Colorado Springs, CO: USAF Academy, 1990), 2.

[31] R. Michael Worden, *Rise of the Fighter Generals: The Problem of Air Force Leadership, 1945–1982* (Honolulu, HI: University Press of the Pacific, 2002), 168.

the mission: air superiority. Intercepting enemy bombers was the primary type of air-to-air mission for which TAC fighter pilots trained. Accordingly, the fundamentals of fighter-versus-fighter tactics received much less attention in the briefing rooms and practice missions of the operational tactical units.[32]

TAC floundered with regard to its purpose. The culture of TAC was lost and needed reinvigoration. The goal post-Vietnam became resurrecting air-to-air expertise and positioning the community for greater responsibility. Vietnam caused a swing in the political and military environments and TAC had to take advantage of this shift. TAC went back to the basics by focusing on training and instituting programs such as Red Flag and lead-in fighter training.

TAC realized its pilots needed realistic training to prepare for the next war. In the summer of 1972, Major General William P. McBride, the TAC deputy chief of staff for operations, formally acknowledged in a memorandum to General Momyer, now the TAC commander, that "Recent combat operations in the conflict in SEA [Southeast Asia] have highlighted the lack of knowledge and proficiency in aerial combat of F-4 aircrews. Recent reports from Commanders and Operations personnel in SEA have specifically identified a requirement for additional ACT [Air Combat Tactics], particularly, ACT training with more than four aircraft simulating current hit and run tactics."[33] The command developed a robust realistic air combat training program at Nellis Air Force Base in Nevada called Red Flag. The Red Flag exercises brought together units from across the Air Force—and occasionally Army, Navy, and NATO partners—to simulate total force scenarios.[34]

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[32] Hannah, *Striving for Air Superiority*, 13.
[33] William P. McBride. Supporting Document no. 125: "Headquarters, Tactical Air Command, Staff Summary Sheet, August 5, 1972," In *History of the Tactical Air Command, vol. 9, July 1972–1973* (Langley AFB, VA: Headquarters, Tactical Air Command), 1.
[34] Hannah, *Striving for Air Superiority*, 101–102.

In 1973, TAC instituted a second successful training model called the lead-in fighter-training program. Prior to 1973, undergraduate pilot training graduates went from a subsonic training aircraft (e.g., T-41 and T-37) and to the supersonic T-38. Pilots then went to a follow-on fighter unit to learn basic fighter maneuvers (BFM) and tactics in the fighter plane. TAC decided to change the model and teach BFM during the T-38 phase of undergraduate pilot training. This had two effects. First, novice pilots could learn the fundamentals of tactics in a simpler training aircraft, rather than a complex fighter jet, to ingrain the knowledge. Second, the program saved money. It cost nearly 75 percent less to train pilots in the T-38 than in an actual fighter aircraft like the Phantom F-4.[35]

SAC versus TAC: Vying for Power

The conflict in Southeast Asia proved both SAC and TAC had strengths and weaknesses. It exposed an inflexibility of Air Force doctrine and revealed service issues in adapting existing technology to limited wars.[36] Before the war began, SAC was the greatest threat to TAC's existence. Coming out of the Vietnam War, four factors led to the changing of the guards between the two communities, in which TAC rose to prominence: experience, resources (composed of budget and technology), prestige, and finally, advocacy and leadership.

Experience

During the war, SAC faced conflicting priorities. On one side was the continual pull of the nuclear mission and on the other was necessity

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[35] Lawrence R. Benson, "The New USAF Fighter Lead-In Program: A First Year's Progress Report," *Air University Review* 26 (March-April 1975): 57. In 1975, the average total cost per flying hour for a T-38 was $319 versus $1,215 for an F-4.
[36] Donald J. Mrozek, *Airpower and the Ground War in Vietnam: Ideas and Actions* (Maxwell AFB, AL: Air University Press, 1991), 14–17.; Earl H. Tilford, *Setup: What the Air Force Did in Vietnam and Why* (Maxwell AFB, AL: Air University Press, 1991), 38–40.

for conventional operations. SAC bet on the continued development and necessity of nuclear warfare. SAC maintained two-thirds of the nuclear triad and assumed that the political leadership still held the nuclear Cold War mission in the same regard as in decades past. Despite conventional bombing with B-52s in South Vietnam, SAC was reluctant to risk its bombers against SAM or MiG threats and thus left the dangerous flying to TAC. TAC assumed SAC's conventional strategic bombing mission, which resulted in TAC executing the majority of bombing in North Vietnam.[37]

Fighter pilots gained experience on the ground and in the air. They flew CAS missions and served as ground and airborne forward air controllers who worked with ground forces regularly. The work done with ground forces fostered an understanding and credibility between the two communities that lasted after the war. The fighter pilots also added more types of missions to their repertoire, including search and rescue, defense suppression, and strategic bombing. Once again, this led to more missions flown by fighter pilots than bomber pilots.[38]

The greater variety and quantity of combat experience provided fighter pilots with a significant advantage over the bomber cohort in competing for future leadership positions in an Air Force that prized combat and command experience. The fighter culture also took pride in rewarding innovation and delegating flight leadership and other responsibilities to worthy recipients, regardless of rank and age. This trend nurtured the accomplished pilots; that is, those who had received experience in leadership and responsibility at an earlier age than most bomber pilots. Greater involvement offered more opportunities for fighter

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[37] James M. Ford, "Air Force Culture and Conventional Strategic Airpower," (master's thesis, School of Advanced Air and Space Studies, Maxwell Air Force Base, AL, 1993), 27. SAC followed a "no sweat" procedure that if there were any active enemy SAMs or MiGs in the area, the B-52s generally aborted the mission.
[38] Worden, *Rise of the Fighter Generals*, 190.

leaders to conceive and direct innovative tactics in a war that demanded creativity.

Resources: Budget and Technology

SAC's decline rejuvenated tactical air forces. Beginning in 1966, the requirement for fighters to execute multi-role missions in the most threat-heavy environments garnered them political favor in the form of increased resources.[39] The Vietnam War fostered the growth of tactical fighter resources and a decline in strategic bombers, which was a significant and meaningful shift. TAC's increased resources were political recognition of the danger that limited warfare posed, not through annihilation, but against US prestige on the world stage and the impact on the American public's willingness to accept war. The bolstering of fighter forces showed that politicians and military alike needed the best tool for the job in handling the increasing problem in Southeast Asia.

The figures below show an interesting trend. From 1964 to 1968, the number of aircraft, squadrons, and money decreased for strategic bombers and increased for fighters. However, by 1972, bomber resources continued to drop whereas fighter resources leveled out at approximately 1964 levels (Tables 1, 2, and 3). This was a combination of fighter technology and its personnel proving TAC's worth, but also a recognition of the sheer expense of nuclear bombers.

[39] Futrell, *Ideas, Concepts, Doctrine*, 121.

Table 1. Number of Active Aircraft in the Inventory, 1964–1972.

	1964	1968	1972
Strategic Bombers	1,364	714	528
Tactical Fighters	2,200	3,104	2,399

Source: Air Force Magazine. "An Air Force Almanac: The United States Air Force in Facts and Figures," Air Force Magazine 56, no. 5 (May 1973), 151.

Table 2. Number of Air Force Squadrons, 1964–1972.

	1964	1968	1972
Strategic Bombers	78	40	30
Tactical Fighters	79	92	73

Source: Air Force Magazine. "An Air Force Almanac: The United States Air Force in Facts and Figures," Air Force Magazine 56, no. 5 (May 1973), 151.

Table 3. Air Force Budget Allocation for Programs, 1964–1972 (in billions of dollars)

	1964	1968	1972
Strategic Forces	6.530	5.194	4.751
Tactical Forces	3.096	7.256	5.347

Source: Air Force Magazine. "An Air Force Almanac: The United States Air Force in Facts and Figures," Air Force Magazine 56, no. 5 (May 1973), 150.

Technology was a major factor contributing to the shift in power from the bomber to the fighter communities. SAC's air refueling aircraft in Vietnam gave fighters longer-range capability while precision-guided munitions (PGMs) gave fighters better accuracy. In fact, PGMs such as

the Hughes AGM-65 Maverick television-imaging missile, the Rockwell GBU-15 electro-optical homing glide bomb, and the Texas Instruments KMU-351 "Paveway I" semi-active laser homing glide bomb, destroyed targets while minimizing collateral damage. This gave TAC a centerpiece for legitimacy in limited warfare, just as nuclear warheads did for SAC in the Cold War. PGMs also reduced risk to aircrews due to higher release altitudes, which limited exposure to weapons fire and AAA.[40]

PGMs allowed for precision decisiveness in combat.[41] Additionally, SAC looked forward into requirements for new missions by investing in aircraft like the F-15E and the A-10 to develop a continuing advantage in air-to-air and CAS roles. At the same time, SAC seemed determined not to evolve and continued to focus on preserving the mission that garnered it prestige in the past.

SAC focused its budget and efforts on acquiring the B-1 bomber. Unfortunately, the B-1 program was projected to cost $24 billion, and Washington policymakers did not trust SAC's ability to control costs. The program met with numerous hurdles, including a Brookings Institute report published in 1976 which stated that a standoff B-52 force equipped with air-launched cruise missiles (ALCM) was far more cost-effective than a fleet of B-1s.[42] By 1977, most political backing for the B-1 program vanished. On June 30, 1977, President Jimmy Carter did not want to continue production of the B-1. He stated, "This has been one of the most difficult decisions that I have made since I've been in office. Within the last few months, I've done my best to assess all the factors involved in the production of the B-1 bomber. My decision is that we should discontinue plans for production of this weapons system.... The existing testing and development now under way on the B-1 should

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[40] Hannah, *Striving for Air Superiority*, 105–106.
[41] Worden, *Rise of the Fighter Generals*, 191–192.
[42] Alton H. Quanbeck and Archie L. Wood, *Modernizing the Strategic Bomber Force: Why and How* (Washington D.C.: Brookings Institute, 1976).

continue to provide us with the needed technical base in the unlikely event that more cost effective alternative systems should run into difficulty…. In the meantime, we should begin development of cruise missiles using air launched platforms such as our B-52s, modernized as necessary."[43]

Technological zeal, astronomical costs, and ICBM capability undermined SAC's ability to procure a future strategic bomber. Former SAC commander General Bruce Holloway believed the intellectual and cultural rigidity "started SAC's downfall."[44] In some ways, the emotional impact of the war clouded civil and military judgments on how best to develop and use the new technologies—particularly unmanned aviation.[45]

Prestige and Culture

SAC's reluctance to commit totally to the war in Vietnam hurt the command in multiple ways. As discussed, it created a disparity in experience coming out of the war. SAC's stagnant views regarding strategic bombing to win wars also resulted in discredit and lost influence with political leadership. SAC, understandably, never willingly let go of the mantle of prestige it held for so long. However, the culture of superiority created under LeMay and the relegation of TAC to a second-tier status created tensions and heightened tribalism between the two communities. The desire and drive of TAC to overcome its second-tier status and gain prestige within the Air Force drove a mentality of

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[43] J. C. Hopkins and Sheldon A. Goldberg, *The Development of Strategic Air Command 1946-1986 (The Fortieth Anniversary History)* (Offutt Air Force Base, NE: Headquarters Strategic Air Command, 1986), 212–213.
[44] Gen Bruce K. Holloway, (former CINCSAC) transcript of oral history interview by Lt Col Vaughn H. Gallacher, 16-18 August 1977, Air Force Historical Research Agency, 352.
[45] Wayne Thompson, *To Hanoi and Back: the U.S. Air Force and North Vietnam, 1966-1973* (Washington, D.C.: Smithsonian Institution Press, 2010), 281.

preserving "flying" and "fliers" as the greatest possible good, regardless of the needs of the institutional mission or the nation. The two cultures began a power grab for "top status" in the service and that competition focused on the communities and aircrafts rather than on the best decisions for the Air Force. Carl Builder stated, "Manned aircraft, now manned fighter aircraft, became an end in themselves, and other technological means that could provide a better means to 'win the war' were relegated to a secondary role."[46]

The Air Force's emphasis on fighter culture was not abrupt; rather, it was a slow synergistic effect resulting from the nature of airpower in Vietnam and the technological environment. SAC's future as a dynamic command appeared bleak. Its losing position in the prestige battle reflected at the lowest levels. For example, pilot training graduates saw SAC's peacetime missions in cold northern bases requiring pilots to sit alert in old aircraft as undesirable. The allure of flying newer fighter or airlift aircraft and more appealing base locations drew the best talent of pilot training graduates to TAC, and the bottom were forced to go to SAC.[47] Now SAC had to contend with a culture of not having the best pilots but also disgruntled aircrew who were unhappy about their job and location. As years went on, the command lost its external and internal prestige.

Advocacy and Leadership

One influence on TAC's ascension within the Air Force was the influence of leadership, in particular TAC commander General Wilbur L. "Bill" Creech. Creech was a visionary who shaped TAC as much as LeMay shaped SAC in the 1950s. More importantly, he was arguably

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[46] Lynn E. Vermillion, "Understanding Air Force Culture," (Maxwell Air Force Base, AL: Research Report, Air War College, April 1996), 49–50.
[47] Worden, *Rise of the Fighter Generals*, 219–220.

TAC's most significant leader, holding the position from 1978 to 1984. LeMay commanded SAC soon after the Air Force split from the Army, when the command needed a strong advocate to shape the community. Similar to LeMay, Creech used intellect, skill, and an ability to manage personnel to grow TAC. When Creech assumed command on 1 May 1978, he inherited an ailing organization and culture with steadily declining sortie rates and correspondingly high accident rates. TAC also suffered from an enormous problem of pilots leaving the service.

Creech instituted a multitude of reforms to change his command and worked wonders creating a visionary managerial system that propelled TAC's prestige within the Air Force.[48] He decentralized authority to wing commanders, created buy-in and ownership by expanding programs like the "dedicated crew chief program," and allowed people to make mistakes, within reason, so they could learn from them without ending their careers. Additionally, Creech's tenure saw accident rates throughout the command drop from one every 13,000 hours to one every 50,000 hours. By March 1981, under Creech, the average sortie rate (flights per aircraft per month) increased to nearly double and TAC flew 101 percent of allocated flight hours. This achievement overcame 10 years of steadily decreasing sortie productivity. All these factors increased internal pride and purpose in TAC. Additionally, he fathered the idea of destroying the air defense network as a prerequisite to an air campaign against an enemy.[49] The community as a whole was developing a stronger culture based on relevancy and skillful guidance from an effective, forward-looking leader. Creech's most influential

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[48] Walter J. Boyne, *Beyond the Wild Blue: A History of the United States Air Force, 1947-2007* (New York: Thomas Dunne Books, St. Martin's Press, 2007), 227. TAC consisted of 65,000 active duty members and 50,000 civilian personnel in more than 150 separate installations around the world.

[49] Brian D. Laslie, *The Air Force Way of War: U.S. Tactics and Training after Vietnam* (Lexington, KY: University Press of Kentucky, 2015), 70.

ability was grooming future leaders and using the personnel system to ensure the command's systemic success.[50]

Creech noticed a change in the distribution of promotions. The promotion rates to the rank of colonel for both bomber pilots and missileers declined during the period from 1954 through 1971. In 1954–55, SAC officers enjoyed promotion rates that were three times those of the rest of the Air Force. The promotion rates for SAC personnel began to slowly decline below the Air Force average by 1971. Data also revealed that "below the zone" accelerated promotion rates to colonel for individuals identified as high potential and on the "fast track" were below the Air Force average for SAC personnel for all but one year from 1963 to 1971.[51]

Creech's talent for working the personnel system had long-lasting effects. He groomed highly skilled personnel for "below the zone" promotions. Creech personally guided the careers of people he felt were talented and used them to fill positions of greater authority and visibility. TAC's successes allowed it to get out from under the shadow of SAC and subsequently influence the personnel system to institutionalize its control and produce senior-level fighter leadership.[52] Creech strategically placed fighter officers in key positions and their ability to succeed in those positions led to subsequent fighter pilot promotions.

In 1960, of the top 35 leadership positions held by Air Force general officers, over three-fourths were bomber pilots. Both staff and major command positions indicated bomber-centric dominance. Furthermore, bomber pilots held all key staff positions with the exception

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[50] James C. Slife, *Creech Blue: Gen Bill Creech and the reformation of the tactical air forces, 1978–1984* (Maxwell Air Force Base, AL: Air University Press in collaboration with CADRE, 2004), 79–94.; Boyne, *Beyond the Wild Blue,* 229.
[51] Arnold Kanter, *Defense Politics: a Budgetary Perspective* (Chicago: University of Chicago Press, 1979), 102–111.
[52] Frederick C. Mosher, *Democracy and the Public Service* (New York: Oxford University Press, 1968), 122–23.

of Deputy Chief of Staff for Operations. By 1975, the Vietnam War revealed the importance of the fighter community and created a battleground at the senior ranks with neither bomber nor fighter communities dominating the service. The fighter community, thanks to Creech, shifted the balance of general officers heavily in their favor. By 1990, over half of the generals were fighter pilots, a representation that was significantly higher than that from any other community (Figure 4).[53]

[53] Ford, "Air Force Culture and Conventional Strategic Airpower," 33–49.

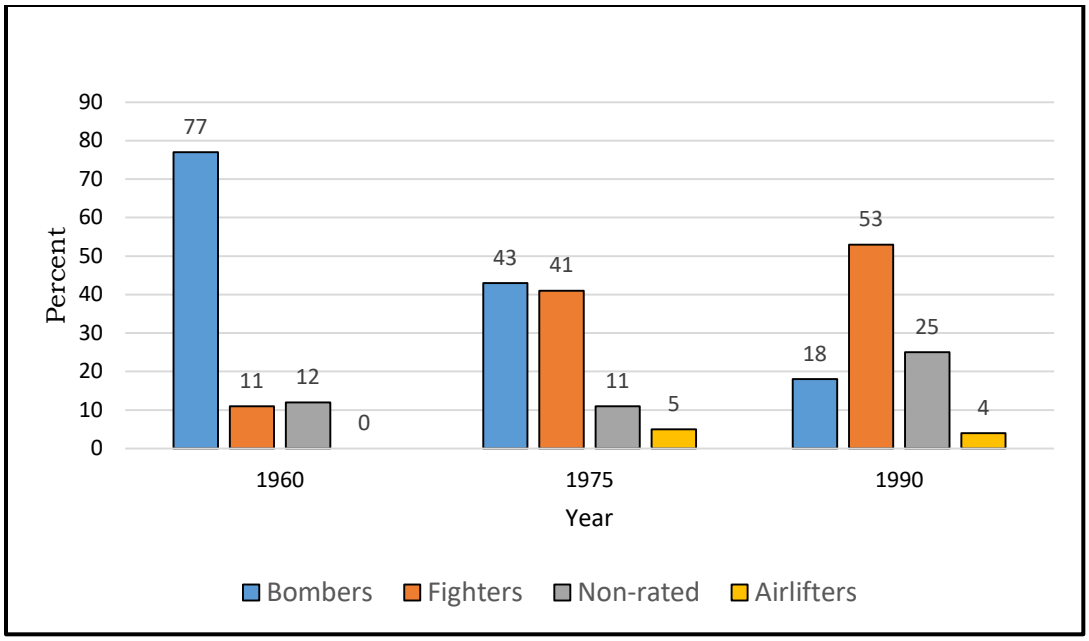

Figure 5. Aircraft Experience of Air Force Leaders

Source: James M. Ford "Air Force Culture and Conventional Strategic Airpower" (master's thesis, School of Advanced Air and Space Studies, 1993), 33–49.

Conclusion

The Vietnam War was one of the most challenging conflicts the US has ever had to face. It placed an Air Force wholeheartedly focused on strategic nuclear attack on its heels through limited warfare. The war tested the efficacy of nuclear doctrine. The conflict saw proxy intervention from the Soviet Union and China. North Vietnam's complete investment into the conflict contrasted with the United States' limited interest in the region. Determined to stop the spread of communism, the US intervened in a conflict it was not prepared to conduct.

The failings of American military policy in Vietnam created lingering tensions between the military and political leadership. The Vietnam War also created a divide within the Air Force. Despite conducting mutually beneficial operations during the war, the changing

fiscal environment and the strength of their respective cultures created a fight for Air Force dominance between SAC and TAC.

SAC and TAC were equally unprepared for the war in Vietnam. Despite signs the limited war in Vietnam was protracted, SAC decided to maintain and devote resources to its "nuclear first" posture. In so doing, SAC did not utilize aircraft and resources, which relegated them to a second-hand status during the conflict. TAC executed the preponderance of North Vietnamese strikes; however, it was woefully unprepared regarding air-to-air tactics and CAS because of having adopted the tactical nuclear mission. TAC was a learning organization and changed to accommodate the new environment. The relevance of TAC during the conflict garnered the command more money and resources. The advent of PGMs gave TAC weapons to maximize effects and reduce risk in a limited war.

By the end of the war, SAC and TAC headed in two different directions, both internally and in relation to each other. Internally, TAC grew and increased in prominence and relevance. Increased promotion rates and responsibility invigorated the TAC community. SAC, on the other hand, was spiraling downward. Their people did not have the same job satisfaction, their force was shrinking, and many lost their purpose. Similarly, in relation to each other, TAC flourished in the perceived zero-sum game of Air Force cultural dominance. The relationship between SAC and TAC reached a tipping point resulting in TAC assuming the position of dominance in the Air Force. The experiences gained from flying difficult and risky missions, an increasing budget, a culture-solidifying purpose, and new leadership helped mold TAC into a powerhouse within the Department of Defense (DOD). The importance of leadership during the rise of TAC was especially important. Creech used the personnel system to push his personnel into higher positions similar to what LeMay accomplished with SAC.

The “changing of the guard” between SAC and TAC was not a smooth transition. Decades of animosity and tension finally came to a head. The institutional and cultural strain between SAC and TAC had lasting implications regarding the direction of the Air Force, leadership opportunities, and decision-making. Additionally, the cultural conflict had a significant effect on long-term vision for the service. The Lightning Bug was one casualty of the SAC-TAC war that not only disappeared after Vietnam, but the RPV technology failed to resurface for nearly 20 years.

Chapter 4

Rise and Fall of the Lightning Bug

Drones went into areas where conventional airplanes wouldn't live. You could not take an RF-4 and fly it, by itself, up into the heavily defended areas and expect to live and get out alive. It would come back shot up, or it wouldn't come back with the photography. They were the main source of battle damage assessment.

General John W. Vogt,
Seventh Air Force Commander (PACAF)

The United States saw Soviet Union and Chinese involvement and aid to North Vietnam as a threat to South Vietnam and America's liberal democracy. President Lyndon B. Johnson's administration feared the spread of Communism to Southeast Asia. Maintaining South Vietnam's independence and balancing Soviet and Chinese intervention in Vietnam became paramount for the United States. In his book *The Limits of Airpower: The American Bombing of North Vietnam*, Mark Clodfelter wrote in regard to the fear of Soviet or Chinese intervention, "Preventing Chinese or Soviet intervention-and hence World War III—became a goal equal in importance to that of establishing South Vietnamese independence."[1] The strategy going into the war involved the various instruments of national power: political, economic, information, and military. However, the US was indecisive on how ground forces should conduct the war. In order to overcome this uncertainty, General William Westmoreland relied on airpower and covert operations to interdict the Viet Cong external operational and logistical lifelines.[2] The

[1] Mark Clodfelter, *The Limits of Air Power: The American Bombing of North Vietnam* (New York: Free Press, 1989), 43.
[2] Andrew J. Birtle, *U.S. Army Counterinsurgency and Contingency Operations Doctrine, 1942–1976* (Washington, DC: Center of Military History, U.S. Army, 2006), 362–363.

unconventional counterinsurgency environment required unique and innovative airpower solutions.

Aerial reconnaissance was one area of particular importance during the Vietnam War. Photographs revealed enemy movements, supply routes, orders of battle, possible vulnerabilities, and numerous high-value systems such as MiG-21s. Remotely piloted vehicles (RPVs) proved one of the most valuable assets in collecting reconnaissance during the war. The Air Force's workhorse in RPV capabilities was the AQM-34 Lightning Bug, developed by Ryan Aeronautical. The Lightning Bug unmanned platform evolved as a system while the war progressed, becoming capable of high-fidelity photography, real-time video, signals intelligence (SIGNINT), electronic intelligence (ELINT), real-time communications intelligence (COMINT), and leaflet dropping psychological operations, among other missions.

Rise of the Lightning Bug

In the early 1960s, Ryan Aeronautical maintained a basic Model 147 Firebee RPV. While using it as a target drone, the designers and Air Force leadership realized the flexibility the Firebee provided. Political leaders saw the aircraft, in its Cold War context and as a method of gathering intelligence on the Soviet Union. Unfortunately, the United States never used the Firebee because of its 800-mile range, which precluded strategic reconnaissance deep into the Soviet Union.[3] In 1962, the Air Force awarded Ryan Aeronautical a contract to produce RPVs in conjunction with the Big Safari program.[4] Big Safari was an Air Force

[3] Bill Yenne, *Attack of the Drones: A History of Unmanned Aerial Combat* (St. Paul, MN: Zenith Press, 2004), 23. To provide adequate coverage of the Soviet Union, the Firebee required an operational range of more than 2,000 miles.

[4] Established in the early 1950s, the Air Force used Big Safari as a means to modify existing aircraft for reconnaissance missions. Working toward the Fire Fly, Big Safari

program that provided management, acquisition, modification, and logistics for special-purpose weapons such as RPVs. Big Safari's rapid acquisition and testing made it the ideal test bed for improved RPV technology. Ryan Aeronautical and Big Safari produced an improved version of the Firebee target drone called the Fire Fly, which resolved numerous issues and operational constraints. By May 1962, the Fire Fly included a high-quality camera and demonstrated survivability against manned fighters.[5]

Reconnaissance drone development crystallized after the 27 October 1962 downing of a U-2 spying on Soviet nuclear sites. A Soviet surface-to-air missile (SAM) destroyed the aircraft, increasing the necessity for an aircraft that would minimize political exposure. The Cuban Missile Crisis also created a need to balance rapid intelligence gathering and political sensitivities. This led to the development of the Lightning Bug as an improvement on the Fire Fly to remove the risk of pilot deaths or exploitation of downed aviators by the Soviets. SAC assumed responsibility for the Lightning Bug because of the RPV's capability for strategic reconnaissance. In July 1963, the 4080th Strategic Reconnaissance Wing welcomed the first drone reconnaissance unit in the Air Force.[6]

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initially modified four Firebee target drones to achieve a 1,200-mile range, a cruising altitude over 55,000 feet, and a photo resolution of two feet.

[5] John D. Blom, *Unmanned Aerial Systems: A Historical Perspective* (Fort Leavenworth, KS: Combat Studies Institute Press, 2010), 56. The Air Force conducted live-fire exercises against the Fire Fly to test its survivability against manned fighters. The fighters, five F-106s, all fired four air-to-air missiles and failed to destroy the drone.

[6] William Wagner, *Lightning Bugs and other Reconnaissance Drones* (Washington: Armed Forces Journal, 1982), 44-50. William Wagner worked for Ryan Aeronautical, and his book contains key interviews with Ryan personnel. His books, along with *Fireflies and Other UAVs (Unmanned Aerial Vehicles)*, are the best and most referenced primary sources on the subject.

How the System Worked

In comparison to other classified or "black world" reconnaissance aircraft, such as the U-2 or A-12, the Lightning Bug provided multiple benefits, such as the ability to cover targets too heavily defended or politically sensitive for manned reconnaissance aircraft.[7] The technology was unique and multifaceted in comparison to traditional aircraft. First, the air vehicle included the airframe, propulsion unit, flight controls, and electric power system. The air vehicle was equipped with a payload, usually cameras, but some variants included niche capabilities such as signals intelligence (SIGINT) equipment, jammer equipment, and even propaganda leaflets.

Next, a four-engine DC-130 cargo aircraft, also called the "mothership," carried the RPVs under its wings. The DC-130 had a maximum carriage capacity of four Lightning Bugs but typically carried two per mission.[8] The crew onboard the mothership consisted of a traditional pilot, co-pilot, navigator, and flight engineer. An RPV aircrew, also onboard, consisted of two launch control officers (LCOs), an airborne recovery control officer (ARCO), and a radar technician to monitor the mission and make course corrections as required. Launching the Lightning Bugs from airborne DC-130s gave the RPVs increased range to prosecute farther targets.

Each Lightning Bug flew waypoints along a preprogrammed mission route to provide reconnaissance on several targets per mission. The RPV used ultra-high frequency (UHF) transmitters for two-way communication, either upon demand or on a continuous basis, to control the RPV when required. Along the route, the navigation system kept the aircraft on its path, and the camera system took photos of desired targets

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[7] Curtis Peebles, *Dark Eagles: A History of Top Secret U.S. Aircraft Programs* (Novato, CA: Presidio, 1995), 83.

[8] The DC-130s launched in pairs for redundancy.

or areas of interest. A drone's flight time was typically 55 minutes and covered 430 nautical miles. When the drone completed its reconnaissance mission, it flew to a predetermined point for recovery, deployed a parachute, and floated to the ground.[9]

Initially, recovery for the Lightning Bug was problematic. The parachute system deployed but lacked directional control; thus, high winds often blew the RPV into undesirable locations such as the ocean, rice paddies, or jungles. Additionally, high surface winds caused hard landings that damaged reconnaissance film.[10] A second DC-130 had to retrieve the drone from the recovery site, remove and package the film, put it onboard a courier jet, and fly the film to Offutt Air Force Base, Nebraska, for interpretation, due to limited in-theater processing capability.[11]

By 1966, developers created the Mid-Air Retrieval System (MARS) as a method to overcome the damaging parachute landings. Upon mission completion, the ARCO passed control to a drone recovery officer (DCO) onboard a CH-3H Little Jolly helicopter. At a pre-programmed altitude, the Lightning Bug deployed a drag chute, and the helicopter caught it in midair. Once collected, the helicopter delivered the drone to a recovery zone.[12] The MARS required significant helicopter aircrew training and specifically configured CH-3Hs. Despite its complexity, MARS proved to be an effective recovery methodology. Out of 2,745

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[9] Laurence R. Newcome, *Unmanned Aviation: A Brief History of Unmanned Aerial Vehicles* (Reston, VA: American Institute of Aeronautics and Astronautics, Inc., 2004), 84.

[10] Paul G. Fahlstrom and Thomas J. Gleason, *Introduction to UAV Systems*, Second ed. (Columbia, MD: UAV Systems Inc., 1998), VI-19.

[11] Newcome, *Unmanned Aviation*, 84.

[12] Ann Rogers and John Hill, *Unmanned: Drone Warfare and Global Security* (New York: Pluto Press, 2014), 22. The aircrew manipulated two 20-foot-long hydraulically operated poles and an array of three hooks. The helicopter crew snagged the parachute's cords and, with a winch that fed 1,000 feet of steel cable out of a reinforced hole in the helicopter's floor, reeled the 2,000-pound drone into a position about 20 feet underneath the helicopter.

attempted recoveries, 2,655 were successful, for a nearly 97 percent success rate.[13] To minimize risk to aircrews, launch and recovery operations were limited to the permissive air environment such as north of Saigon at Da Nang in South Vietnam, and in Thailand.[14]

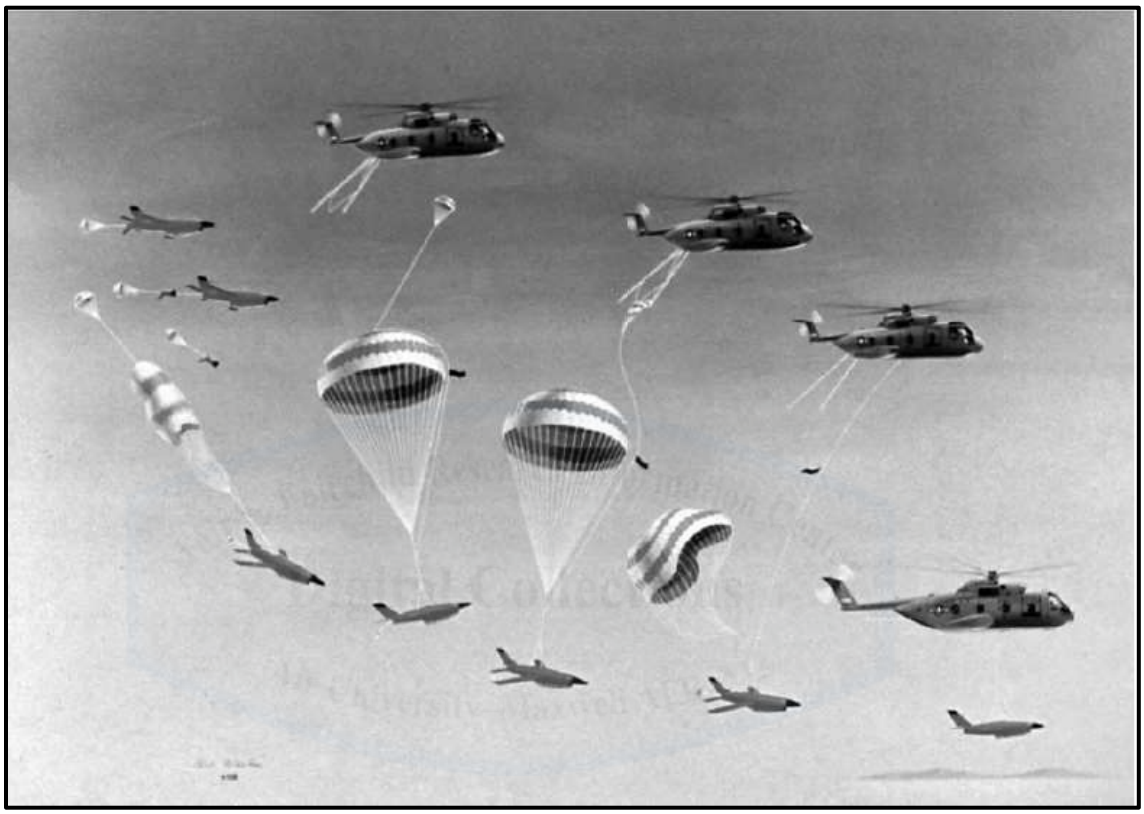

Figure 6. The Mid-Air Retrieval System (MARS) Process

Source: R. Cargill Hall, Reconnaissance Drones: Their First Use in the Cold War, Air Power History, Fall 2014, 26.

[13] Dave Sloggett, *Drone Warfare: The Development of Unmanned Aerial Conflict* (New York: Skyhorse Publishing, 2015), 81.
[14] Paul W. Elder, *Project CHECO Southeast Asia Report: BUFFALO HUNTER 1970-1972* (Hickam AFB, HI: Pacific Air Forces CHECO Division, 24 July 1973). AFRA file no. K717.0414-39.

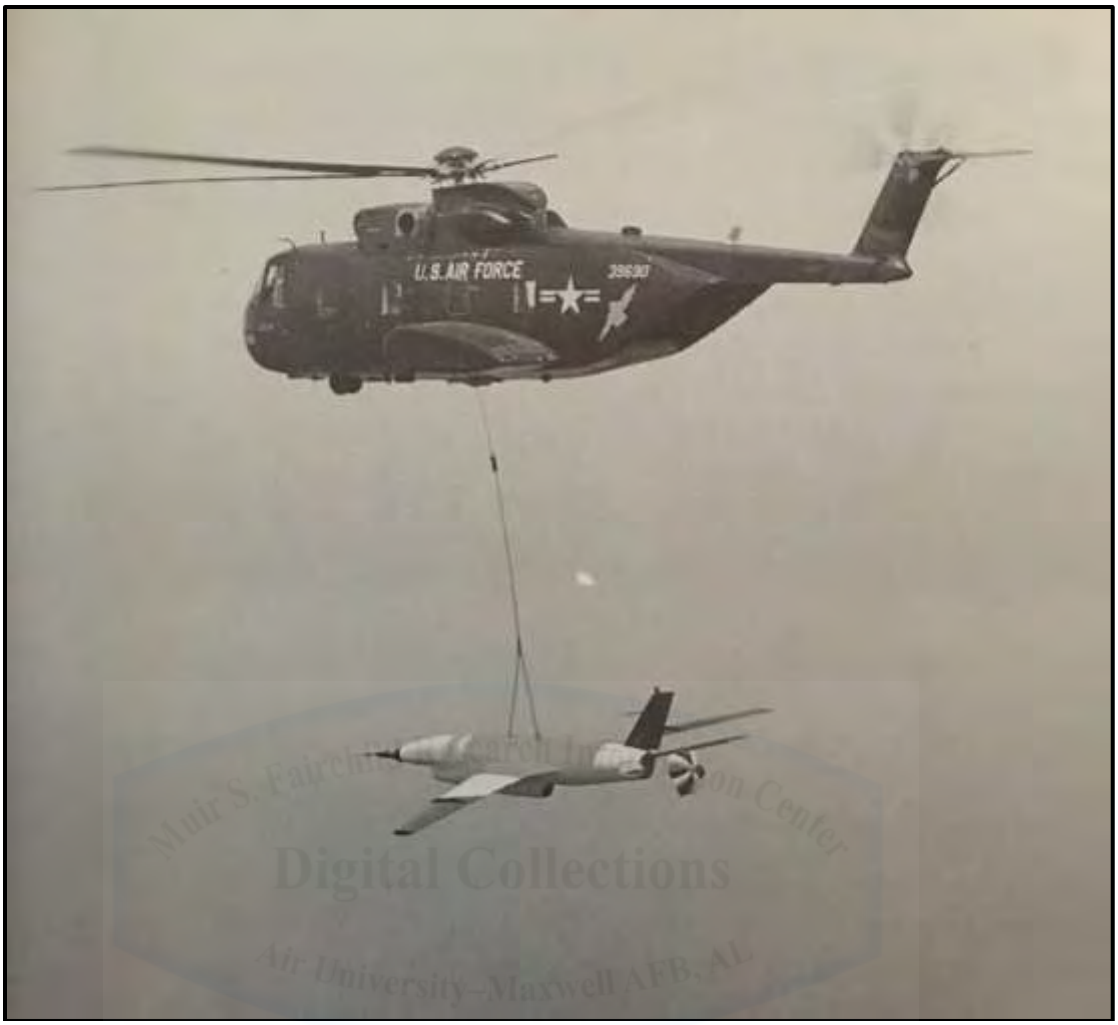

Figure 7. CH-3 Helicopter Recovers a Lightning Bug.

Source: William Wagner and William P. Sloan, Fireflies and other UAVs (Unmanned Aerial Vehicles) (Midland, 1992), 5.

Lightning Bugs entered the Pacific theater before the US intervention in the Vietnam conflict. SAC Lightning Bugs became the aircraft of choice after the People's Liberation Army Air Force shot down multiple CIA U-2 aircraft.[15] The first Lightning Bug missions flew along

[15] Steven J. Zaloga, *Unmanned Aerial Vehicles: Robotic Air Warfare, 1917-2007* (Oxford: Osprey, 2008), 12. The Lightning Bug was extremely beneficial for aerial reconnaissance but operated poorly during the monsoon months of November through

the coast and interior of southeastern China beginning 20 August 1964.[16] However, as the US military's focus began to pivot from China to Vietnam, so too did the direction of Lightning Bug assets. SAC transferred the RPVs to Bien Hoa Air Base, in South Vietnam 20 miles north of Saigon, in October 1964 and began seeing action over North Vietnam in late 1965.

The successes of the Lightning Bug program created high demand for their capabilities in Vietnam. The RPVs showed effectiveness in various ways. The most significant accomplishments of the Lightning Bug dealt with reconnaissance, intelligence gathering, filling capability gaps, and minimizing risk. However, as the Lightning Bug was finding its niche, the cultural battle for dominance between SAC and TAC was also brewing.

Reconnaissance

Vietnam changed how the Air Force viewed and employed drones. Initially, they were target apparatus for friendly forces to practice engagements or used as decoys against the enemy. The Lightning Bug's projection of reconnaissance capability into North Vietnam was important. The RPVs obtained most of the reconnaissance photographs from dangerous airspace environments due to North Vietnamese air defenses. High- and low-altitude photographs, and later real-time videos, provided detailed images. The photographs revealed the precise locations of missile encampments, enemy airfield locations, and shipping activity.[17]

In Vietnam, RPVs accounted for nearly half of the total missions. The Lightning Bug's most influential capability was low-altitude

March as clouds obscured most targets.
[16] Newcome, *Unmanned Aviation*, 83.
[17] Wagner and Sloan, *Fireflies and other UAVs*, 10.

reconnaissance. Operation Buffalo Hunter saw RPVs attaining high-resolution photography while flying underneath cloud cover. Equipped with the Fairchild 415Y low-altitude camera, reconnaissance photographs provided useable 120-nautical mile strips of imagery in three-nautical-mile swaths that resolved objects as small as six inches.[18] During the war, the Lightning Bugs recovered over 100,000 feet of film for exploitation.[19]

On 17 June 1983, retired General John Vogt, Jr., who had previously held the positions of Seventh Air Force commander and deputy commander of Military Assistance Command, Vietnam, stated, "I am a great believer in drones. I used drones in a reconnaissance role very effectively."[20] The Seventh Air Force Deputy Chief of Staff for Intelligence noted the important role the RPVs played in evaluating the air threat, calling Buffalo Hunter "the primary photo resource contributing to the assessment of [the] SAM and air threat to 7AF air operations in this theater."[21]

The Lightning Bug took pictures of not only future targets but also targets recently struck. Battle damage assessment (BDA) became an important role for RPVs. Their low-altitude capabilities confirmed that US strike aircraft hit their designated targets. For example, during Operation Linebacker II, Lightning Bugs flew 93 percent of reconnaissance sorties.[22] The high-quality reconnaissance taken during

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[18] Rogers and Hill, *Unmanned: Drone Warfare and Global Security*, 22.
[19] Newcome, *Unmanned Aviation*, 86.
[20] Richard H. Kohn and Joseph P. Harahan. *Air Interdiction in World War II, Korea, and Vietnam: An Interview with Gen. Earle E. Partridge, Gen. Jacob E. Smart, and Gen. John W. Vogt, Jr.* USAF Warrior Studies (Office of Air Force History, Washington, D.C., September, 1986), 88.
[21] Major General J. J. Jumper quoted in Paul W. Elder, *Project CHECO Southeast Asia Report: Buffalo Hunter 1970–1972* (Hickam AFB, HI: Headquarters Pacific Air Forces, CHECO Division, 1973), 28.
[22] Thomas P. Ehrhard, "Unmanned Aerial Vehicles in the United States Armed Services: A Comparative Study of Weapon System Innovation" (PhD Diss., John Hopkins University, 2000), 424.

the operation by RPVs bolstered Vogt's testimony before Congress regarding the progress of Linebacker II. Vogt stated, "I know of no other way we could have obtained the information we needed during the intensive combat activity of the December period."[23]

The Lightning Bug was not without limits, especially with target-coverage issues. An evaluation of airpower in Southeast Asia, conducted by Air University during the conflict, noted that the ratio of targets assigned and attempted, versus actually covered, averaged 40 percent early on in the war. The biggest contributor to the ineffectiveness of target service was navigation. The inability of the Lightning Bug to accurately position itself over the target or close enough to the planned track was its greatest limitation. In an effort to resolve the issue, the AQM-34M and subsequent versions were equipped with a long-range navigation (LORAN) capability. LORAN updated the position of the RPV as it flew to prevent the accumulation of errors inherent in the Doppler radar system and kept the Lightning Bug within 500 feet of the intended course.[24]

In total, between 1964 and 1975, 1,016 Lightning Bugs flew 3,435 sorties, primarily reconnaissance over North Vietnam, China, and North Korea.[25] The intense operational tempo showed senior commanders' reliance on Lightning Bug reconnaissance. By 1972, Lightning Bugs experienced a 90 percent success rate of providing quality reconnaissance imagery.[26] Despite a rapidly changing conflict, the Lightning Bug program only improved in its reconnaissance mission as the war continued.

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[23] General John W. Vogt, Jr. quoted in Elder, "Buffalo Hunter," 37.
[24] Corona Harvest. Lecture transcript on drones and remotely piloted vehicles. Air University Library, M-U-43002, 1972, 45-48.
[25] Of the 3,435 total sorties, 2,873 were recovered (83.6 percent). The anticipated life expectancy of a Lightning Bug in combat over Vietnam was only 2.5 sorties, but they ultimately averaged 7.3 missions.
[26] Fahlstrom and Gleason, *Introduction to UAV Systems*, I-2.

Figure 8. Photograph of Enemy AAA Battery from a Low-Altitude Lightning Bug.

Source: Wagner and Sloan, Fireflies and other UAVs, 8.

Intelligence Gathering

Most Lightning Bug missions took photography and real-time video; other vital missions involved SIGINT, electronic intelligence (ELINT), and communications intelligence (COMINT). The combination of photography and the various intelligence capabilities proved significant. For example, Lightning Bugs photographed and used ELINT on critical

enemy MiG and SAM defenses.[27] One mission uniquely suited to RPVs was SIGINT acquisition of SAM sites.

The SA-2 SAM system posed a grave threat to all aircraft and necessitated manned reconnaissance platforms to stay out of their missile engagement zones. E-model Lightning Bugs equipped with active radar-enhancing wave-guides mimicked larger aircraft like U-2s on enemy radars and drew the focus of the SA-2 Fan Song fire control and tracking radar. On 13 February 1966, the Lightning Bug made history by detecting the command-link signal from the Fan Song E radar system to a Guideline missile for the first time. The Lightning Bug acquired and transmitted the data before the missile destroyed the RPV. Arguably, acquiring the command signal was one of the most momentous intelligence feats of the Vietnam War. The signal data provided military leaders with two-uplink channels used to control the SA-2 missile. With this information, the uplink channels gave the military the ability to either jam or manipulate the command signals so that the missiles missed their targets. More importantly, the information enabled the development of safety measures for manned aircraft. The uplink channels spurred development of radar warning receivers on manned aircraft. This enabled pilots to know when the SA-2 command link became active and an engagement was imminent, giving them time for appropriate defensive maneuvers.[28]

The Lightning Bug flourished at conducting ELINT. In June 1969, North Koreans shot down an EC-121 with 31 men onboard tasked with intelligence gathering off the North Korean coast. The incident prompted President Richard M. Nixon to cease manned aircraft missions using

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[27] Anthony M. Thornborough, *Sky Spies: Three Decades of Airborne Reconnaissance* (London, England: Arms and Armor Press, 1993), 35.
[28] Sloggett, *Drone Warfare*, 82–83.

electronic warfare against North Korea.[29] Military leaders looked to the Lightning Bug for assistance. The RPV was equipped with systems to listen to verbal radio transmissions and other intelligence-gathering missions and then transmit the information up to 600 miles to defense centers throughout the theater. COMINT variants collected critical information about North Vietnam's and China's air defense systems and tactics as well.[30]

As an intelligence platform, the Lightning Bug was a resounding success. It fulfilled its mission and led to the development of new resources to help manned aircraft become safer. The RPV proved its worth and executed missions neither traditional SAC nor TAC assets could fulfill. Although both communities benefited from the Lightning Bug's production, neither fully embraced the unmanned technology. Ultimately, the greatest strength of the Lightning Bug was its flexibility. The aircraft's malleability to meet the needs of the dynamic wartime environment manifested in various way throughout the Vietnam War.

Filling Capability Gaps

As the Vietnam War progressed, the Lightning Bug continued to evolve to meet the needs of commanders. The different variants of Lightning Bugs did not just demonstrate the capability of American engineers but also provided a testament to focused American ingenuity. Vietnam proved to be a pivotal time for RPV growth. The platforms were robust and easily modified into variants for different types of missions. The Air Force saw 23 versions of the Lightning Bug created, most with

[29] Dennis Larm, "Expendable Remotely Piloted Vehicles for Strategic Offensive Airpower Roles" (Master's Thesis, School of Advanced Airpower Studies, Maxwell Air Force Base, AL, June 1996), 17.
[30] Carl O. Schuster, "Lightning Bug War: Over North Vietnam," *Vietnam* 25, no. 5, 2013, 52.

unique specialties. So each variation was suited to certain types of missions, which limited flexibility.[31]

Early versions of the Lightning Bug were big-wing, high-altitude, day photo Model-Bs. These versions were capable of flying at altitudes in excess of 50,000 feet and gathering high-resolution photographs. To counter overcast weather and minimum SAM operational thresholds, developers created a low-altitude variation capable of flying at 1,000 feet AGL and above at speeds of 500–540 knots. One variant was fitted with chaff dispensers, which blinded radar operators by creating a large reflection that filled their scopes. Another Lightning Bug mounted an AN/ALQ-51 active deception jamming system onboard to test its effectiveness against the SA-2 before installation on manned aircraft.[32]

The H-model was one of the least exotic variants. In July 1972, political leaders required Lightning Bugs to bolster the propaganda war against North Vietnam. Manned aircraft were unable to fly deep into enemy territory and drop leaflets and subsequently return undamaged. Several AQM-34Hs, modified with external pods, dropped leaflets with a message from President Nixon in an attempt at psychological warfare. These missions were unsuccessful, and while known as project "Litter Bug" in more tactful circles, operational troops referred to them as "Bullshit Bombers."[33] Another version included night capability with strobe flashes to illuminate the target area. Developers outfitted another variant with air-to-ground missile launchers, which included AGM-65 Maverick and Stubby Hobo TV-guided missiles and 250- and 500-pound general-purpose bombs.[34]

The Lightning Bugs gave developers the ability to create niche

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[31] Line replaceable modifications refer to new hardware or software that provides a specific capability. They are added to the aircraft before specific missions and removed for other flights, which provides an aircraft fleet the greatest flexibility.
[32] Schuster, "Lightning Bug War: Over North Vietnam," 52.
[33] Wagner and Sloan, *Fireflies and other UAVs,* 9.
[34] Newcome, *Unmanned Aviation*, 83.

variations quickly to overcome specific threats or challenges. Table 4 shows all the Lightning Bug variants, most created to overcome tactical challenges during the Vietnam War. For example, the weather and cloud coverage in the area spurred the creation of a low-altitude variant. The rapid development process and tempo of RPVs was beneficial and not easily replicated in manned aircraft.[35] Even as Lightning Bugs flew low-altitude overflights of prisoner-of-war (POW) camps and provided a morale boost, these high-risk missions were unacceptable for manned assets, but not for the RPVs.[36] The evolution of the Lightning Bug drove toward one significant end—saving US lives.

[35] Zaloga, *Unmanned Aerial Vehicles*, 12.
[36] Dana A. Longino, "Role of Unmanned Aerial Vehicles in Future Armed Conflict Scenarios" (Air University Library M-U 40084-7 no. 92-12, Maxwell Air Force Base, AL: Air University Press, 1994), 3-4.

Table 4. Ryan Reconnaissance Model Directory

Ryan 147 Model	Military Model	Mission	Month / Year Operated	# Launched	% Return	Most Flights by an Aircraft
A		Fire Fly - first recce demo drone	Apr 62-Aug 62			
B		Lightning Bug - first big-wing, high-altitude day photo aircraft	Aug 64-Dec 65	78	61.5%	8
C		Training and low-altitude tests	Oct 65			
D		From C for electronic intel.	Aug 65	2		
E		From B for high-altitude electronic intelligence	Oct 65-Feb 66	4		
F		From B - electronic countermeasures	Jul 1966			
G		Longer B with larger engine	Oct 65-Aug 67	83	54.2%	11
H	AQM-34N	High-alt. photo; more range	Mar 67-Jul 71	138	63.8%	13
J		First low-altitude day photo (BLACS)	Mar 66-Nov 67	94	64.9%	9
N		Expendable decoy	Mar 66-Jun 66	9	0.0%	
NX		Decoy and medium-altitude-altitude day photo	Nov 66-Jun 67	13	46.2%	6
NP		Interim low-altitude day photo	Jun 67-Sep 67	19	63.2%	5
NRE		First night photo (from NP)	May 67-Sep 67	7	42.9%	4
NQ		Low-alt. NC; hand controlled	May 68-Dec 68	66	86.4%	20
NA/NC	AQM-34G	By TAC for chaff and ECM	Aug 68-Sep 71			
NC	AQM-34H	Leaflet dropping	Jul 72-Dec 72	29	89.7%	8
NC(M1)	AQM-34J	Interim low-altitude , day photo and for training				
S/SA		Low-altitude day photo	Dec 67-May 68	90	63.3%	11
SB		Improved SA low-alt. aircraft	Mar 68-Jan 69	159	76.1%	14
SRE	AQM-34K	Night photo version of SB	Nov 68-Oct 69	44	72.7%	9
SC	AQM-34L	The low-altitude workhorse	Jan 69-Jun 73	1651	87.2%	68
SC/TV	AQM-34L/TV	SC model with real-time TV	Jun 72	121	93.4%	42
SD	AQM-34M	Low-alt. photo; real-time data	Jun 74-Apr 75	183	97.3%	39
SDL	AQM-34M(L)	SD bird with Loran navigation	Aug 68	121	90.9%	36
SK		Navy operation from aircraft carrier	Nov 69-Jun 70			
T	AQM-34P	Larger engine; high-alt. day photo	Apr 69-Sep 70	28	78.6%	
TE	AQM-34Q	High-alt.; real time COMINT	Feb 70-Jun 73	268	91.4%	34
TF	AQM-34R	Improved long-range TE	Feb 73-Jun 75	216	96.8%	37
				3435		

Source: Wagner and Sloan, Fireflies and other UAVs, 13.

Minimizing Risk

The complexity and duration of the Vietnam War was not what most political and military leaders had expected when they entered the conflict. One significant miscalculation was underestimating the speed of growth and effectiveness of North Vietnamese anti-aircraft artillery (AAA). In 1964, the North Vietnamese air defenses included 1,400 AAA guns, 22 acquisition radars, and four fire control radars. Early 1965 saw an increase from 22 acquisition radars to 31, in addition to nine fire control radars and 30 MiG-15 and MiG-17 fighters. In addition, by mid-1965, the North Vietnamese had acquired SA-2 SAM systems. The SA-2 system was Soviet made and highly capable, designed to shoot down strategic bombers and high-flying U-2 reconnaissance aircraft. The SA-2 had a range of 17 nautical miles and was effective from 3,000 feet to above 50,000 feet. This presented a challenge for both SAC and TAC assets.[37] The US estimated that by the beginning of 1967, the North Vietnamese had 7,000-10,000 AAA guns and more than 200 confirmed SA-2 sites. By August 1967, the North Vietnamese had launched at least 3,500 SA-2 missiles and had destroyed 80 US aircraft.[38]

The North Vietnamese use of SAMs was not very effective against American fighters directly, but they were able to force American fighters to altitudes of 3,000 feet in the heaviest AAA environment ever seen. As Benjamin Lambeth noted in his book *The Transformation of American Air Power*, "The lethal blend of AAA, radar-guided SAMs, and MiGs creating an envelope of overlapping fire from near-ground level to the higher-altitude regime above 25,000 feet made operation in the skies over North

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[37] Marshall L. Mitchell, *Clashes: Air Combat over North Vietnam, 1965-1972* (Annapolis, MD: Naval Institute Press, 2007), 29.
[38] Benjamin S. Lambeth, *The Transformation of American Air Power* (Ithaca, NY: Cornell University Press, 2000), 17.

Vietnam an enterprise in which no altitude was safe."[39] The threats were real, resulting in the destruction of nearly 60 percent of all F-105s available to air defenses for combat in Southeast Asia.[40] At the same time, SAC bomber crews relegated themselves to targets in South Vietnam to avoid the dangerous environment of the north.

The Lightning Bug afforded various methods to save lives. As the American people began to question the validity of US involvement in Vietnam, political leadership understood the importance of minimizing casualties. RPVs removed the risk to fighter and bomber pilots in the areas where radar systems tracked and engaged aircraft. The RPVs had various affect on the casualty acceptability calculus of civilian and military leaders. First, as discussed, RPVs entered AAA and SAM threat rings to draw fire and gather SIGINT. The RPVs proved effective decoys and kept manned aviators from flying unnecessarily into danger. Second, the Lightning Bugs caused the destruction of MiG fighter aircraft. The MiGs either crashed by trying to intercept the RPVs, or SA-2 missiles attempting to shoot down the Lightning Bugs missed and hit the MiGs.[41] Third, Lightning Bugs saved numerous pilots by informing fighter aircrew when SAMs were firing at them.

The Vietnam War resulted in over 5,000 American lives lost in Southeast Asia due to aircraft being shot down or malfunctioning. Additionally, 90 percent of the Americans who became POWs were downed pilots or crewmembers. Despite its relative infancy, the

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[39] Lambeth, *The Transformation of American Air Power*, 17.
[40] Craig C. Hannah, *Striving for Air Superiority: The Tactical Air Command in Vietnam* (Texas: Texas A & M University Press, 2002), 47-48.
[41] To achieve "Ace" status, traditionally, a person has to shoot down five enemy aircraft. Interestingly, one drone earned "ace" status because it was involved in the loss of five North Vietnamese fighters. The Lightning Bug also proved to be far more resilient than anyone expected. The anticipated life expectancy of a Lightning Bug in combat over Vietnam was only 2.5 sorties, but they ultimately averaged 7.3 missions. The S-model called "Tom Cat" set the record by flying 68 sorties before being lost on 25 September 1974.

Lightning Bug provided life-saving options for aircrew to avoid the potential of death or capture. Compared to manned aircraft, the Lightning Bug flew missions at far less cost, whether measured in money, lives, or political risk. The RPV provided a technological fix to lethality and attrition problems in the war. Despite the political climate, how did the Air Force lose stake in a capability proven to meet political and military desires of effectiveness and risk?

Fall of the Lightning Bug

The accolades of the Lightning Bug during Vietnam showed how capable the system was at making quick modifications to meet battlespace demands while providing valuable reconnaissance and intelligence. The RPV system provided needed capabilities in a warfare-limited environment and promised future possibilities. The Air Force, as an institution, should have relished the capability to reduce risk to personnel. Yet, for all the Lightning Bug's achievements and possibilities, its survival was at risk after the Vietnam War. The RPV was caught in the intense competition between major commands. The cultural clash between SAC and TAC, at its apex, had multiple repercussions.

Following Vietnam, the Air Force saw its two major commands grappling for primacy within the service. The struggle between SAC and TAC revealed a growing issue in the Air Force in the power and influence of subcultures, which were overriding the Air Force's overall culture. The rise of the RPVs proved no match. The shift from SAC to TAC dominance was an important step in the downfall of RPVs. The "tug-of-war" between the two commands created a tectonic shift that crushed the Lightning Bug program in the quake. Major factors that influenced the demise of the Lightning Bug included utility issues, budget, cultural biases, and a lack of advocacy.

Utility

The challenge for RPVs was not utility in wartime, but rather demonstrating continuing value in peacetime. In the late 1970s, SAC began losing ground to TAC, which became more influential among civilian leadership due to its successes in the war. Utility proved a factor for RPVs in three ways: TAC's experience in Vietnam, the lack of a strategic bombing survey, and political implications.

As TAC began taking a more prominent role in the Air Force, so did its decision-making influence. For TAC leaders, Lightning Bugs were limited and did not meet all their requirements. During Vietnam, SAC controlled RPV missions through its Strategic Reconnaissance Center (SRC), which gave priority to national-level reconnaissance requests instead of tactical mission needs. Senior tactical Air Force leaders operating in Southeast Asia felt that TAC's lower priority for national-level reconnaissance made an RPV unresponsive to the tactical commander. Additionally, TAC felt the prioritization impaired their ability to plan combat activities. [42] Additionally, the priority for RPVs as national-level reconnaissance emphasized the latent feelings between the two commands. TAC, while operating in a conflict not optimized for SAC, was still lower on the prioritization totem pole. Furthermore, the massive force required to put RPVs into action—the air vehicle, launch and control aircraft, and recovery helicopter—decreased their usefulness to TAC, thus increasing resistance and decreasing funding as TAC took over the Air Force.[43]

The lack of a postwar airpower survey also affected perceptions of utlity. After World War II, the United States Strategic Bombing Survey

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[42] General John W. Vogt, Jr. in Elder, *Project CHECO Southeast Asia Report*, 36.
[43] Comptroller General of the United States, *Report to the Congress: DOD's Use of Remotely Piloted Vehicle Technology Offers Opportunities for Saving Lives and* Dollars (Washington D.C.: General Accounting Office, 1981), 16.

(USSBS) investigated the German economy to reveal the effectiveness of the strategic aerial bombardment. Additionally, the USSBS provided a historical record of lessons learned and laid the foundation for future air policy and theory.[44] The USSBS, while not perfect, did provide valuable insight for future analysis. The USSBS's failing was its objective to prove specific agendas. In the case of Vietnam, those same strategic bombing-minded leaders were still in power. The combination of SAC's desire to maintain primacy of mission and a fear of a rising TAC led to suppressing an USSBS-type analysis of Vietnam. Additionally, many politicians, military members, academics, and the general populace considered Vietnam a strategic failure and a war that Americans wanted to forget. In the same vein, SAC wanted to forget the Vietnam War and thus did not push to extrapolate its successes and failures. The institutional tribalism and desire for dominance resulted in the lack of a true analysis that might have revealed the importance, utility, and potential for RPVs.

A third issue regarding utility was political restrictions. By 1978, a separate multi-role RPV—a variant of the Lightning Bug—that had been planned for reconnaissance, electronic combat, and air-to-ground strike missions faced significant cost and technical issues. Because of these challenges, TAC quickly tried to cancel the RPV program. Additionally, these multi-role versions not only faced contention with TAC but also met political constraints. The potential strike capability of RPVs drew considerable debate. The Strategic Arms Limitation Treaty (SALT) II, signed in 1979, included restrictions on cruise missiles and, based on the language, included munitions-carrying RPVs. The terms of SALT II

[44] Gian P. Gentile, *How Effective is Strategic Bombing?: Lessons Learned from World War II to Kosovo* (New York: New York University Press, 2001), 35-38.

designated unmanned aircraft as a strategic weapon, even though they lacked a nuclear mission or nuclear armed capability.[45]

Combined, TAC's experience in Vietnam, the lack of a strategic bombing survey, and political implications affected how SAC and TAC viewed RPVs. TAC saw the Lightning Bug as a SAC tool and not something it wanted to retain as it reshaped the Air Force. SAC did not want the fledgling technology because it drew attention and money away from its primary strategic bombing and nuclear assets. Since the structure of domination was shifting, both commands fought to structure the service in their tribal image for relevance. The Lightning Bug was a distraction that both commands summarily dismissed.

Budget

The Air Force budget had a great deal to do with the demise of RPVs after Vietnam. Most people have assumed the cost of the Lightning Bug was exorbitant and ultimately not fiscally possible to sustain. In total, the Lightning Bugs cost approximately $200,000 each, including navigation systems and cameras.[46] In 1975, John L. McLucas, secretary of the Air Force, wrote in a *Commander's Digest* article, "Most of our operational work in the past was based on the high attrition or the political rationale, but now we must more fully exploit the cost advantage aspect as well."[47]

The battle over RPV control continued after the Vietnam War. In 1976, SAC and the National Reconnaissance Office (NRO) dissociated themselves from unmanned aircraft, and TAC assumed control of Air Force RPVs. TAC's perspective on unmanned aircraft was rooted in

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[45] Ehrhard, "Unmanned Aerial Vehicles in the United States Armed Service," 451-455.
[46] Elder, *Project CHECO Southeast Asia Report*, 4-6. The price of $200,000 per drone in 1966 equates to approximately $1,460,000 in 2016.
[47] John L. McLucas, "The Role of RPVs in the Air Force," *Commander's Digest* 17, no. 3, 16 January 1975, 12.

discontent with the RPV budget requirements and an aversion to what the systems represented. The dissolution of the unmanned aircraft under TAC began with the removal of RPVs from the classified domain and Big Safari process. Under the classified and Big Safari umbrella, unmanned aircraft acquired necessary funding and expedient development. Furthermore, Air Force leadership demanded significant cost advantages and high reliability from new RPVs. These requirements, nonexistent in black world development, illuminated costs and technological obstacles TAC leaders were unwilling to invest for continued development.[48]

Ultimately, after moving from the black world of the NRO into a normalized acquisition system, the poor cost and schedule performance combined with limited operational utility in peacetime led to TAC's ability to dissolve the RPV budget.[49] On June 1971, Air Force Chief of Staff General John D. Ryan stated, "drones have demonstrated an excellent potential for use in tactical reconnaissance and electronic warfare. Although the austere budget situation has had an adverse effect on the tactical drone program..."[50] Ryan's perspective illuminates, that as the war ended, the classified budget program was both a blessing and a curse for the Lightning Bug.

Additionally, and not surprisingly, both SAC and TAC found themselves advocating for the newest technologies and aircraft. SAC, still wielding intercontinental ballistic missiles (ICBMs) and a strategic bomber force, desired to develop and field the new B-1 bomber to replace the B-52. TAC fought for funding to acquire a multitude of aircraft, such

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[48] McLucas, "The Role of RPVs in the Air Force," 12-14.
[49] Kevin D. Hickman, "Forgetting Correctly: The Air Force and Strategic Adjustment," (master's thesis, School of Advanced Air and Space Studies, Maxwell Air Force Base, AL, June 2008), 32.
[50] Gen John D. Ryan, Memorandum, Tactical Drones, 5 June 1971, Box 168.7041-41 (May 1971) – 168.7041–54 (July 1972), Air Force Historical Research Agency, Maxwell Air Force Base, AL.

as the A-7D, A-10A, F-15A, F-5E, F-4E, and F-111E. The competition between SAC and TAC for money meant advocating for systems that exemplified their roles and missions and appealed to policy makers and the public. New fighter jets and the sleek B-1 were visually appealing and helped with marketing and recruiting. The RPV did not fit in either camp's business model for intellectual and financial investment, and thus did not garner any funds. In fact, RPVs became a capability to disband in order to garner more funds for other airframes. In 1978, Senator John Tower (R-Texas) stated, "I suggest that a full-blown strike RPV program that would really impact on the numerical differences will not be easy for the Air Force to be enthusiastic over. The reason is that the Pentagon budget process is such that new programs are seldom recognized as complementary to, but rather substitutes for."[51] Between SAC and TAC, the acquisition of assets meant increased influence, and the expansion of squadrons opened up leadership opportunities to further that tribe's maintenance of power or ascension through the ranks.

However, by 1980, the major Air Force funding for unmanned aircraft dropped to zero (Figure 9). In 1981, the comptroller general of the United States reported to Congress that RPVs were cheaper than manned aircraft due to elimination of the crew support system, cost reductions in design and construction (cheaper materials), and cheaper and easier maintenance. Moreover, RPVs provided highly efficient fuel consumption and reduced training costs, and unlike with manned aircraft, no capital investment was lost due to pilot flying deaths.[52] SAC and TAC agreed not to fund classified RPV procurement in favor of other, manned aircraft priorities.

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[51] William E. Krebs, "Did We Err in the Development of Remotely Piloted Vehicles (RPVs)?" Research Report no. MS 018-79 (Maxwell Air Force Base, AL: Air War College, 1979) 47.

[52] Comptroller, *Report to the Congress*, 3.

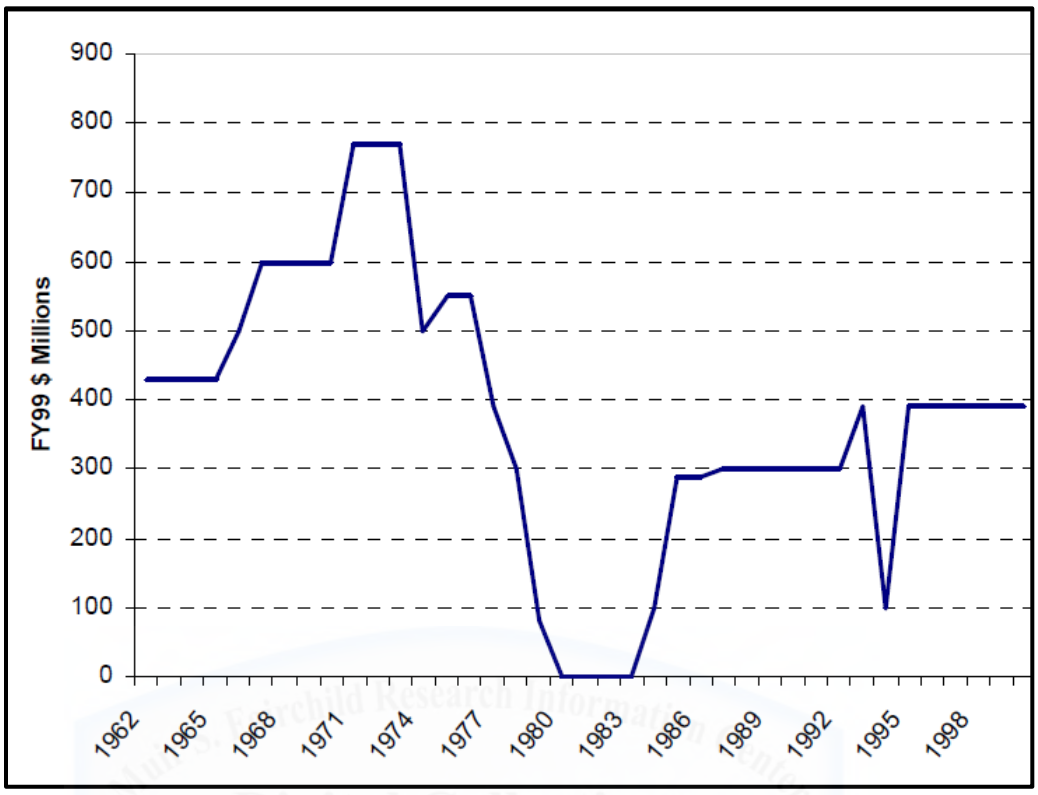

Figure 9. Major USAF Unmanned Aircraft Program Funding

Source: Ehrhard, "Unmanned Aerial Vehicles in the United States Armed Services."

Culture and Biases

Another influence leading to the downfall of the Lightning Bug were cultural and bias factors. As described in previous chapters, both SAC and TAC had unique and strong cultures that permeated the Air Force. SAC was the dominant voice until the end of the Vietnam War and TAC, the upstart command rising to prominence. The culture of the communities showed how the RPV community did not fit into either one and challenging them both.

Due to the tribal focuses of the Air Force, SAC and TAC focused on the capabilities that would increase their foothold rather than the best

solutions for the military and the United States. This created a propensity to confuse image with mission. [53] Objectively, the Lightning Bug was a technology consistent with traditional airpower theory. The purpose of the combined bomber offensive was to save the lives of army and naval forces by using airpower to create effects or influence. Although RPVs were still not fully mature in capabilities, the potential for them to fly long distances into areas of danger and keep other aviators safe was not far off.

The battle for relevance and culture still loomed behind the scenes as Vietnam drew down and another interwar period began. Because of the Air Force's internal conflict, the unmanned aircraft community made little progress in developing either a career path for rated officers or a sense of identity. The Air Force's need to have a person in the loop caused repression of one of its greatest capabilities. Ultimately, the Air Force detached itself from political desires to reduce endangerment of military personnel by accepting risk and not continuing to develop the RPVs. This realization is perhaps the most damning indictment of the impact of the SAC and TAC cultural clash. In essence, Air Force leaders put organizational dominance above the future safety of their people.

Amidst fighting against SAC and TAC, cultural issues plagued the Lightning Bug community regarding job satisfaction and progression. The rapid development and deployment of RPV technology left the Air Force behind the power curve when meeting training requirements. The reconnaissance drones entered production just prior to the escalation of the war; therefore, the Air Force had limited time to train personnel before placing them in theater. The second problem had to do with the outlook of Air Force personnel regarding career progression within the RPV community. Many reconnaissance aviators believed, perhaps

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[53] Lynn E. Vermillion, "Understanding Air Force Culture," (Research Report, Air War College, Maxwell Air Force Base, AL, April 1996), 45.

correctly, that working in a drone unit instead of a U-2 unit would stall their careers. In an attempt to rectify this, the Air Force eventually created an airborne missile-maintenance squadron, which put Lightning Bug units on the same organizational level as the U-2 units.[54] However, programs are only as good as the leaders who push them, and when senior-level acceptance for RPVs was still noncommittal, this indifference reverberated throughout the lower echelons.[55]

In 1976, plans progressed for the shift of the 355th Tactical Fighter Wing from Twelfth to Ninth Air Force and the eventual change of Davis-Monthan Air Force Base from SAC to TAC control.[56] Additionally, the move consolidated all RPV assets into a single organization to develop a more viable force structure.[57] Activated on 1 July 1976, the mission of the 432d Tactical Drone Group (432 TDG) was to maintain capability to deploy the reconnaissance drone force to any theater; this involved conducting necessary training and testing systems until they reached initial operational capability.[58] The response to the high tempo of Vietnam operations with a surplus of assets drove the drone group's

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[54] Blom, *Unmanned Aerial Systems*, 62. This was an important conundrum for the Air Force to address because the pilots' beliefs resulted in decreased morale in drone units. Pilots sent to those units felt as though their careers were over or assumed that they were at the bottom of the pack when compared to their peers.

[55] One significant event in October 1965 helped the perceptions of UAS. In a joint U-2/RB-47/Lightning Bug mission, the drone purposely drew SA-2 fire while the U-2 and RB-47 stood aside to record and report on the intercept tactic used. That cooperation for a common cause—plus the visual impact of watching what a SAM could do to an aircraft—helped convert reconnaissance pilots.

[56] MSgt John W. McCoy, History of the 355th Tactical Fighter Wing: Davis-Monthan Air Force Base, Arizona, 1 April-30 June 1976. Box K-WG-355-HI (1 April 1976-30 June 1976). Air Force Historical Research Agency, Maxwell Air Force Base, AL, 4.

[57] SSgt Dennis A. Bonewitz, History of the 355th Tactical Fighter Wing: Davis-Monthan Air Force Base, Arizona, 1 January 1976-31 March 1976. Box K-WG-355-HI (1 January 1976-31 March 1976). Air Force Historical Research Agency, Maxwell Air Force Base, AL, 19.

[58] Headquarters Tactical Air Command, Special Order GA-25, 8 June 1976. Document found in Heise, MSgt Ronald C. History of the 432nd Tactical Drone Group: Davis-Monthan Air Force Base, Arizona, 1 July 1976-30 September 1976. Box K-GP-RCN-432-HI (1 July 1976-30 September 1976). Air Force Historical Research Agency, Maxwell Air Force Base, AL.

creation. A by-product of the formation of this unit was the creation of an environment of inclusion and self-worth among pilots who felt negatively affected by the drone assignment. The 432 TDG leadership encompassed a melting pot of aeronautical specialties. At the end of 1976, the aircraft flown by the group included nine DC-130A/E Hercules and RC-130A aircraft, nine CH-3E Jolly Green helicopters (MARS modified), and 45 AQM-34 Lightning Bugs of various versions (L, M, and V).[59] Unfortunately, joining the Lightning Bug community was not career enhancing because it lacked the opportunities and institutional stature afforded to manned aircraft.

RPVs, due to their detached control, lacked the excitement of aerial combat or the risk that many pilots found alluring. Unlike previous periods of history, unmanned aircraft disaffection became less about technological shortcomings and more about the attitude of the users.[60] The fighter culture especially harkens to days of bravado, the importance of human resolve, and will in aerial combat. Mythologies of pilots flying "by the seat of their pants" garnered reverence. The idea of remotely piloting an object did not have the same allure. The paradigm that manned flight was paramount permeated throughout the Air Force, and RPVs presented a disruptive technology that compelled a different worldview and a new way of reasoning.[61] These cultural issues led to institutional biases.

The root of institutional biases against RPVs was that, for the Air Force, they fell under the umbrella of aviators. This inherently created a

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[59] MSgt Vincent L. Daubenspeck, Report. History of the 432d Tactical Drone Group: Davis Monthan Air Force Base Arizona, 1 October–31 December 1976, Box K-GP-RCN-432-HI (October–December 1976) – K-GP-RCN-432-HI (January–June 1977), File K-GP-RCN-432-HI (1 October 1976–31 December 1976): 4-2, Air Force Historical Research Agency, Maxwell Air Force Base, AL.
[60] Wagner, *Lightning Bugs*, Foreword.
[61] Timothy P. Schultz, "The Problem with Pilots: How Physicians, Engineers, and Airpower Enthusiasts Redefined Flight," (Manuscript, 19 November 2016), 207.

conflict because Air Force leaders were primarily manned aircraft pilots. The competition between manned and unmanned platforms came back to the allocation of money and highlighted the already competitive Air Force, military, and international landscapes. Unfortunately, two problems arose for anyone who would have sided with unmanned over manned aircraft development since both were distinct cultural paths. First, those leaders would be working against their own future, as they were traditional pilots, and second, they threatened to go against the fellowship of their subculture. The society created by subculture is powerful due to personal connections, career advancement, and heritage.[62] Despite the intentions to complement manned missions, the notion of RPVs threatened established subcultures.

The institutional biases led to reluctance to change. The perception that the Lightning Bug program was driving pilots out of the cockpit was not palatable for most Air Force senior leaders, leading to an under-exploitation of RPV capability. In a 1980 Government Accounting Office survey regarding RPVs, "pro-pilot bias" was frequently the reason given for not advancing the use of RPV technology. The unmanned system represented an unknown that made people uncomfortable. Those surveyed also indicated that limited career advancement opportunities hurt RPV operators and that the perception of RPVs as too drab generated little enthusiasm and fostered user apathy.[63] Interestingly, the public noticed the failure to capitalize on RPV technology. In 1973, an article in *Aviation Week & Space Technology* stated, "Ironically, it was the military that first sparked major industry interest in the UAS [unmanned aerial systems] concept … but currently, the military is providing inertia preventing major progress in this field at the pace that technology now

[62] Wagner, *Lightning Bugs*, Foreword.
[63] Comptroller, *Report to the Congress*, 20.

permits."[64] The clash created a culture-focused Air Force where people and capabilities had to fit on one side or the other. Biases grew from those cultures and influenced perceptions of RPVs and a reluctance to advocate for the systems despite their usefulness. Because of the two commands, the Air Force lost its integrating vision because aviators became enamored with their specific weapons systems and forgot the purpose and ends for the aircraft.

Lack of Advocacy

The final major factor that led to the inability for RPVs to survive during the SAC and TAC turmoil was their lack of a champion at a high enough rank to cultivate the community, similar to what Brigadier General William "Billy" Mitchell was for airpower or General Bernard Schriever was for the ICBM program. Top-down advocacy is important to creating a reputation of validity for any community within the Air Force, military, and political entities. Lack of advocacy derived from the lack of an advocate for RPV and the classified nature of RPVs.

During and after the Vietnam War, both SAC and TAC had influential leaders guiding the commands. Generals Curtis LeMay and Bill Creech had keen intellects and tactical credibility, and they understood how to use the personnel system for their command's benefit. Stephen Rosen describes in his book *Winning the Next War: Innovation and the Modern Military* how important a fast-rising three-star or four-star general officer is to developing a community. The individual must be able to select people into the program who are committed to the innovation, create shared goals, understand problems, and recognize opportunities and necessities for change. As Rosen further explains, tapping into and gaining the support of these middle-tier officers who are

[64] Robert Hotz, "The Promise of RPVs," *Aviation Week & Space Technology*, 98, no. 4, January 1973, 7.

fast-rising through the ranks is vital; they represent the greatest opportunity for socialization of innovation because they are likely to have the greatest connection with the majority of the organization.[65]

Unfortunately, the Lightning Bug did not have anyone who had the rank to overcome the bomber and fighter cultures. As 1st Lieutenant Frederick Mathis, historian for the 432nd Tactical Drone Group at Davis-Monthan Air Force Base, Arizona, wrote on 31 March 1979, in the last submission of the unit's history, "This history also marks the end of the 432 TDG as a unit, at least for now. The announcement to close the unit was made on 6 December 1978 by Arizona Congressman Morris K. Udall. The Group was officially absolved on 31 March 1979. Tight fiscal constraints and a lack of high-level support spelled the demise of the 432nd, as we yielded to higher priorities."[66]

Another aspect that led to a lack of advocacy was the classified nature of RPVs. Few senior Air Force leaders knew the accomplishments of the Lightning Bug program. Even fewer mid-level officers and enlisted understood the Lightning Bug's influence unless closely associated with the program either as an enabler or consumer of RPV products. This lack of transparency did not allow many senior leaders to fully comprehend the scope of accomplishment of the Lightning Bug, let alone advocate for it against other well-known and highly visible programs.

Conclusion

America and the Air Force rode the leading edges of airpower prestige in the 1950s and 1960s. The erosion of confidence and trust in

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[65] Stephen Peter Rosen, *Winning the Next War: Innovation and the Modern Military* (Ithaca, N.Y: Cornell University Press, 1994), 20, 78.

[66] 1st Lt Frederick W. Mathis. "Unit History of the 432nd Tactical Drone Group. Box K-GP-RCN-432-HI" (Air Force Historical Research Agency, Maxwell Air Force Base, AL, 1 January 1978-31 March 1979).

airpower coincided with the dwindling cultural fixation with aerial flight as in decades past. The newness of the air domain dissipated, and as comfort and complacency settled in, new wonders like space travel began to excite the population.[67] However, despite the overall view of airpower, the Air Force fought an internal struggle between its two leading agents—SAC and TAC.

In some ways, the Lightning Bug was a product and victim of Vietnam. The Lightning Bug changed the paradigm of what RPV technology could provide military commanders. The successes of the Lightning Bug included substantial reconnaissance photography and real-time video that aided in target identification, enemy movements, and orders of battle. Various forms of intelligence such as SIGINT, ELINT, and COMINT allowed not just for the acquiring of information but also provided redundancy to manned aircraft performing similar roles. The RPV's dynamic capability for rapid modification and crew training allowed for quick reaction to the changing military and political pressures of the Vietnam War. The sharp rise of RPV usage led to substantial interest for those who knew about the program.

While the Vietnam War and its limited character enabled the rapid development of the Lightning Bug, the conflict also indirectly led to its demise. The war gave TAC a platform that it exploited to contend against SAC dominance. The institutional conflict between the commands ultimately removed the Lightning Bug from the operational landscape. Utility, budgets, culture and biases, and a lack of advocacy all contributed as ammunition against the RPV. Dominating the Air Force required tribal relevance, credibility, and identification. RPVs did not fit in either command, nor did it aid in bolstering their positions in the

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[67] Steven Charles Call, "A People's Air Force: Air Power and American Popular Culture," (PhD Diss., The Ohio State, OH, July 1997), 370.

minds of leaders. In 1976, TAC took over the Lightning Bug program and within three years, the entire RPV program was retired.[68]

One cannot dismiss the oversights made by the Air Force because of external and internal cultural differences. By going away from unmanned aircraft, it weighed culture higher than risk. With the rise of the fighter pilot, that risk equaled glory in the air. The constant challenge for the military is the difficulty of being prepared for the next fight. The organizational "brain dump" of RPVs opened up the Air Force to the potential for finding itself in a future conflict needing a capability it had once possessed and would have to go back and relearn or begin again. The Air Force cannot invest in everything; however, even minimal fiscal or intellectual investment into the capabilities could have yielded substantial fruit.

[68] Jones, "Unmanned Aerial Vehicles," 12. Of the retired force, thirty-three refurbished "stealthy" AQM-34s went to Israel, but the bulk remained in storage.

Chapter 5

Conclusion

Once you have an innovation culture, even those who are not scientists or engineers – poets, actors, journalists – they, as communities, embrace the meaning of what it is to be scientifically literate. They embrace the concept of an innovation culture. They vote in ways that promote it. They don't fight science and they don't fight technology. If I always appear prepared, it is because before entering on an undertaking, I have meditated long and have foreseen what may occur.

Neil deGrasse Tyson

The history of unmanned aircraft predates manned flight. Over the years, humankind developed various systems in an effort to exploit the air domain. Prior to the Cuban Missile Crisis, unmanned technology was not cost effective and did not produce effects worthy of significant investment. Due to a desire for secrecy, Strategic Air Command (SAC) refrained from using reconnaissance remotely piloted vehicles (RPVs) during the Cuban Missile Crisis. Vietnam became the tipping point when the balance of affordability and capability shifted to produce the AQM-34 Lightning Bug. The Lightning Bug gave civilian and military leaders a new arrow in their quiver to overcome battlefield complexity.

Long after Vietnam, beginning in the 1990s, unmanned aerial vehicles (UAVs) and remotely piloted aircraft (RPAs) have become the fastest-growing weapon system in the military. The utility of persistent observation, rapid strike capability, force projection, and minimization of risk to life makes these assets some of the most sought after capabilities by combatant commanders. Unmanned aircraft history reveals Vietnam as a watershed juxtaposing the inefficient pre-1950s technology against the extreme value of recent years. If the Air Force chose to accept the

technology, it potentially could transform the service. Alternatively, if the service cancelled RPVs, the institutional knowledge and legacy might vanish. As Colin Gray has noted, the American defense community has a short-term memory and is largely ahistorical.[1] In that vein, the Air Force chose to abandon RPV technology after Vietnam and by 1980, no remnants of Lightning Bugs remained. This paper diagnosed various reasons why the Air Force rejected RPVs in an effort to find the underlying problem.

This investigative effort began with understanding the context of the two major commands of the time, Strategic Air Command (SAC) and Tactical Air Command (TAC). SAC emerged during the Cold War as a powerhouse, garnering a majority of the money, accolades, and political backing. SAC advertised its criticality as the lone entity capable of protecting the US from the Soviets. With the nuclear bomb as its trademark, SAC dominated the Air Force and Department of Defense (DOD) landscapes. This domination was important in the perpetual earning of prestige, but it also alienated other commands, namely TAC. The cultural friction exuded by both communities set the conditions leading up to, during, and after Vietnam.

While SAC oversold its capabilities and enhanced America's reliance on it, the command was internally struggling. Inadequate training, a lack of adherence to standards, and poor morale stifled SAC's culture. Ultimately, the efforts of SAC's more charismatic and well-known leader, General Curtis E. LeMay, reformed the organization. His ability to reformulate standards, address the needs of the command, and use the personnel system solidified SAC's elite culture and mind-set.

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[1] Gray, Colin S. "The American Way of War: Critique and Implications" in Anthony D. McIvor, *Rethinking the Principles of War* (Annapolis, MD: Naval Institute Press, 2005), 28.

The culture of TAC matured at a far different pace than SAC. TAC did not have a strong advocate initially and struggled to gain a foothold in the Air Force. TAC held a mediocre position within the hierarchy of military power and felt the brunt of SAC's bullish tendencies. The Korean War provided the command a glimpse into a possible niche in limited warfare, which SAC was suited to combat. The Korean War also highlighted the growing animosity between the two commands. Leading into Vietnam, TAC failed to prepare for the limited war environment as it began investing in an enhanced nuclear role, fighting for survival and in an attempt to stay relevant. TAC needed a significant event to occur in order to sway the cultural balance of power. The cadre of skilled fighter pilots hungered for the opportunity to prove themselves.

Vietnam provided TAC an opportunity to refine its mission and capabilities. Both commands failed to prepare for limited warfare; SAC's rigidity kept them stuck in a combined bomber offensive (CBO) mindset. The command told the public and political leadership that the threat of the Soviet Union was paramount and, thus, SAC was unable to relinquish the grip on the very notion that garnered them power. SAC relegated their missions to targets in South Vietnam and kept a large portion of their forces in the US on alert. TAC, on the other hand, was able to adapt and took on the high risk missions in North Vietnam, earning them accolades and combat experience. TAC also did a better job evolving after the conflict by enhancing ongoing training for their fighter pilots.

Additionally, the introduction of precision-guided munitions (PGMs) revolutionized TAC. PGMs gave the community a significant capability optimized for the limited war. Soon after Vietnam, TAC's greatest leader, General Wilbur "Bill" Creech assumed command. His ability to reinvent the organization and use the personnel system to benefit his pilots led to the longest period of community dominance in Air

Force history. TAC was a better learning organization, but fell victim to the seduction of cultural dominance.

Ultimately, the battle between SAC and TAC had serious consequences on the evolution of Air Force innovation. During the Vietnam War, a valuable capability emerged that proved beneficial for air and ground forces. The Lightning Bug performed reconnaissance missions, gathered various forces of intelligence, performed psychological operations, executed shows of force, and, most importantly, removed risk to aviators. Factors like utility in peacetime, shrinking interwar budgets, and even biases from Air Force leaders contributed in tiny increments to the Lightning Bug's demise. However, the decisive reason was the cultural clash between SAC and TAC that manifested into issues and excuses to shelve the groundbreaking weapon system.

Implications

Three significant implications arise from this study of the Lightning Bug. The analysis goes beyond cost and targets serviced and looks at how culture bleeds into all areas of an organization. First, one of the reasons for tension between SAC and TAC was separation of the commands. This created inherent competition for talent, budget, and resources. When SAC and TAC merged into Air Combat Command in 1992, the bomber and fighter communities did not have the same level of competition. Both operated out of the same budget, met the same boards for promotion, and recognized talent relatively evenly. With the 2009 establishment of Global Strike Command (GSC), and as of 2015 the addition of the B-1 bomber into GSC, bombers and fighters are separate and in competition once again. In addition, there are more commands fighting for larger portions of the Air Force budget. While currently RPAs, cyber, and space are established entities, the Air Force must be

cognizant of how cultural clashes between commands affect decision-making and acceptance of new technologies and communities.

Second, TAC and RPVs earned their stripes in the Vietnam War. The importance of conflict as a necessary ingredient to create a cultural shift is compelling. The ability for a community to exploit a conflict with a unique capability that increases tactical, operational, and strategic effects as well as influence while minimizing cost is a recipe for the establishment and maturation of new communities. The conflict highlights the community, but an advocacy is required to crystallize it. Advocacy is vital for the sustainment of a new culture. In reviewing the evolution of the Lightning Bug, the lack of advocacy is a significant contributory factor to the Lightning Bug's ultimate demise. SAC and TAC gained prominence due to strong, insightful leaders who managed their personnel. The cultural environment in the 1970s did not produce a champion for RPVs. The RPV community needed a three- or four-star general able to advocate for the systems and their importance among the other general officers. As the Air Force operational landscape introduces new technologies, members must realize that both a conflict that accentuates the need for the capability and a strong advocate are required to gain a lasting position in the Air Force and, potentially, Army, Navy, and Marine inventories.

Finally, with the modern-day success of RPAs, similarities exist between the rise of TAC and the rise of RPAs. The numerical increase of RPA squadrons versus the decrease in fighter squadrons mirrors the rise in TAC fighter squadrons and the reduction of SAC squadrons. This is important because squadron command is a key mechanism for promotion and ascension into higher ranks. Growth of RPA squadrons leads to more opportunities for promotion; therefore, more officers in that community are able to take advantage and influence vital positions within the Air Force. In addition, the costs associated with RPAs are

drastically lower than ever-increasing fighter jet costs. This is similar to the reduced costs of fighter aircraft in the late 1970s versus SAC strategic bombers. This pattern indicates that the Air Force is potentially on the cusp of another cultural revolution—producing the rise of RPA generals.

Areas for Further Research

The examination of the Lightning Bug revealed numerous areas for future research. This paper is primarily historical but is relevant to understanding the modern day cultural environment. However, researchers must not rely overly onto the analogies of the past, but rather, must recognize the patterns. The first area for further research is analyzing the other RPVs in the Air Force inventory during the Vietnam War. By 1973, the inventory included the Boeing YQM-34 also known as the Compass Cope B. This RPV had 24-hour endurance capability and carried a 700-pound payload. Next, the Ryan YQM-98A featured long-range, high-altitude surveillance. Third, the Ryan AQM-91A was a large, high-altitude, electronic surveillance RPV. Finally, the Air Force aggressively developed the Ryan BGM-34, which shared the Firebee parentage, to accomplish a variety of missions that at the time required manned aircraft, such as missile and bomb delivery. While these systems did not see significant combat action during the Vietnam War, the development process associated with them during this era might reveal intriguing lessons or aberrations.

The second area of research is dissecting what factors in the 1990s and 2000s created the necessary conditions for RPVs to overcome cultural challenges and remain as mainstays in the Air Force inventory. The tipping point is a fascinating area of study and may reveal how, in a highly bureaucratic organizational structure like the Air Force, certain systems gain momentum toward acceptance and long-term viability.

Additionally, the methods of sustaining or increasing that momentum are worthy of inquiry.

The last area for further research is the civilian-military relationship regarding unmanned aircraft development over time. The military has a long-standing partnership with the civilian sector for innovative processes, mass production, and social acceptance. Examining how those relationships have ebbed and flowed over time may reveal important links that benefit both entities. Additionally, researchers may study how the Air Force can leverage current demand for small and large unmanned aircraft for competitive advantages.

Acronyms

AAA	Anti-Aircraft Artillery
ACC	Air Combat Command
ACT	Air Combat Tactics
ADC	Air Defense Command
ALCM	Air-launched Cruise Missiles
ARCO	Airborne Recovery Control Officer
ARVN	South Vietnamese Army
BDA	Battle Damage Assessment
BFM	Basic Fighter Maneuvers
CAS	Close Air Support
CAP	Combat Air Patrol
CASF	Composite Air Strike Force
CBO	Combined Bomber Offensive
CIA	Central Intelligence Agency
COMINT	Communications Intelligence
COMUSMACV	Commander, US Military Assistance Command, Vietnam
CONAC	Continental Air Command
DCO	Drone Recovery Officer
DMZ	Demilitarized Zone
DOD	Department of Defense
ELINT	Electronics Intelligence
FEAF	Far East Air Forces
GSC	Global Strike Command
ICBM	Intercontinental Ballistic Missile
ISR	Intelligence, Surveillance, and Reconnaissance
JCS	Joint Chiefs of Staff
LABS	Low Altitude Bombing System

LCO	Launch Control Officer
MAC-V	Military Assistance Command, Vietnam
MAD	Mutually Assured Destruction
MARS	Mid-Air Retrieval System
NATO	North Atlantic Treaty Organization
NRO	National Reconnaissance Office
NVA	North Vietnamese Army
PGM	Precision-Guided Munitions
POW	Prisoner of War
RPA	Remotely Piloted Aircraft
RPV	Remotely Piloted Vehicles
RSO	Remote Split Operations
SAC	Strategic Air Command
SAM	Surface-to-Air Missile
SALT	Strategic Arms Limitation Treaty
SEA	Southeast Asia
SIGINT	Signals Intelligence
SRC	Strategic Reconnaissance Center
TAC	Tactical Air Command
TDG	Tactical Drone Group
UAV	Unmanned Aerial Vehicles
UHF	Ultra-High Frequency
USSBS	United States Strategic Bombing Survey

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